ADAPTATION OF THE AADE7 SELF-CARE BEHAVIORS FRAMEWORK TO RACIAL/ETHNIC POPULATIONS WITH DIABETES AND PERCEIVED HEALTH, SELF-CARE, HEALTHY COPING, AND DEPRESSION

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ABSTRACT

Background: Racial/ethnic populations including Black/African-Americans, Asians, Hispanics, and American Indians are at risk for diabetes at rates disproportionately higher than non-Hispanic Whites. In previous studies, persons with diabetes have been shown to have increased rates of depression. In contrast, healthy coping and self-care behaviors improved perceived health among persons with diabetes.

Purpose: The purpose of the study was to explore if race/ethnicity of persons with diabetes was associated with perceived health independent of self-care, healthy coping, and depression, and to further examine the racial/ethnic differences of persons with diabetes in the strengths of the associations of self-care, healthy coping, and depression with perceived health.

Method: Secondary data analysis was performed using the National Health Interview Survey (NHIS) from 2010 to 2014 on 12,671 persons with diabetes aged 18-79 who responded to the question on perceived health. Variables pertaining to race/ethnicity, perceived health, self-care, healthy coping, and depression were analyzed using descriptive analyses and multivariable logistic regression.

Results: There were significant relationships in perceived health of race/ethnicity among persons with diabetes independent of self-care, healthy coping, and depression, but these distinctions were eliminated when interactions between race/ethnicity, self-care, healthy coping, and depression included demographic and co-morbidity factors ($p < .05$). Race/ethnicity does not strengthen the relationship between self-care, healthy coping, depression, and perceived health. Self-care, healthy coping, and depression have a significant independent relationship with perceived health.

Implications: This study indicates the need to consider in addition to race/ethnicity, self-care, healthy coping, and depression, covariates (demographics and co-morbidities) to provide a more comprehensive view of the person living with diabetes. In future studies, it is important to utilize refined statistical measurement tools and methods to address the concept of perceived health among persons with diabetes. Furthermore, there is a need to develop an AADE7 instrument incorporating self-care, healthy coping, depression, and perceived health.

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LIST OF ABBREVIATIONS AND SYMBOLS

AI/AN	American Indian/Alaska Native
NHIS	National Health Interview Survey
RDC	Research Data Center

CHAPTER 1. INTRODUCTION

Diabetes Prevalence and Significance

The International Diabetes Federation (IDF) reported that an estimated 424.9 million people age 20-79 worldwide, or 8.8% of the population, have diabetes (2017). By 2045, the number of persons with diabetes is projected to be 628.6 million (IDF, 2017). The World Health Organization (WHO) (2017) estimated that 8.5% of adults have diabetes. The American Diabetes Association (ADA) (2018) stated that diabetes prevalence in the United States in 2015 was 30.3 million, or 9.4% of the population.

Diabetes complications include cardiovascular disease, retinopathy, nephropathy, and neuropathy (ADA, 2018; WHO, 2017). Racial/ethnic minority populations are at risk for diabetes at rates disproportionately higher than non-Hispanic Whites. For racial/ethnic minorities, 12.7% of non-Hispanic African Americans, 8.0% of Asian Americans, 12.1% of Hispanic Americans, and 15.1% of Native Americans, compared to 7.4% of non-Hispanic Whites have diabetes in the adult population (ADA, 2018). Compared to non-Hispanic Whites, African Americans were 2.1 times as likely to die from diabetes, Hispanic Americans were 1.4 times as likely, and Native Americans were 1.8 times more likely to die from diabetes (U.S. Department of Health and Human Services Office of Minority Health, 2016).

The presence of diabetes in racial/ethnic minorities compared to non-Hispanic Whites increases mortality. There is a link between poor perceived health and mortality. According to the landmark article by Mossey and Shapiro (1982), self-rated health was measured by the question "for your age would you say, in general, your health is excellent, good, fair, poor, or bad?" Participants who rated their health as poor had an increased mortality compared to participants who rated their health as good. For the elderly age 65 and older, the odds of death

were three times more likely for those who rated their health as poor compared to those who rated their health as good (Mossey & Shapiro, 1982).

In some race/ethnic groups, perceived health was worse based on chronic conditions and depressive symptoms. Korean Americans with an increased number of chronic conditions (i e diabetes, hypertension) and depressive symptoms had decreased perceived health (Jang, Chiriboga, Kim & Cho, 2009), as did Chinese Americans (Chun, Chesla, & Kwan, 2011), and Haitian and African Americans (Huffmann et al., 2013). There was an association between perceived health and certain race/ethnic groups. Participants in the United States who self-identified as Black or Other were less likely to report good/excellent perceived health compared to Whites(Song & Lee, 2009).

In contrast, self-care behaviors resulted in good glycemic control, which led to better health (Lloyd, Pambianco, & Orchard, 2010; Zagarins, Allen, Garb, & Welch, 2011). Self-care behaviors for diabetes were important for maximizing health. Measures of self-care management included dietary choices, exercise, and regular dental visits were significant in having better perceived health for self-identified Black/African-American and other populations (Song & Lee, 2009). Black/African Americans who ate fruits and vegetables, monitored blood glucose levels, and performed foot care, decreased their diabetes distress (Hernandez et al., 2014). Similarly, Hispanic Americans also lowered diabetes distress by eating fruits and vegetables, decreasing high fat foods, and performing foot care (Hernandez et al., 2014). Higher levels of depression were significantly related to decreased performance of diabetes self-care in non-Hispanic Black and non-Hispanic White populations (Egede & Osborn, 2010).

Healthy coping includes having social support and exercise. Social support was especially important in dietary adherence and making healthy food choices (Mathew, Gucciardi,

De Melo, & Barata, 2012). Persons with diabetes stated that support came from family and friends who reminded them what should and should not be eaten (Mathew et al., 2012). Exercise for persons with diabetes was also an important part of healthy coping. Increased amounts of exercise was significantly associated with positive perceived health (Li, Lai, Tseng, Lin, & Chang, 2010).

In addition to affecting a disproportionate number of racial/ethnic minority populations, diabetes doubled the odds of having depression, compared to non-diabetics (Anderson, Freeland, Clouse, & Lustman, 2001; Egede, Zheng, & Simpson, 2002), and is associated with increased health care visits and prescription medication use (Egede et al., 2002). Depression has also been associated with decreased glycemic control and self-care (Egede & Osborn, 2010), including diet, exercise, and glucose self-monitoring (Gonzalez, et al., 2007). Changes in perceived health have been highly correlated with changes in depressive symptoms for Korean Americans with diabetes ($p<0.001$) (Jang et al., 2009).

Problem Statement

The relationship between race/ethnicity and perceived health is important. In the current literature on racial/ethnic populations with diabetes, studies on perceived health, self-care, healthy coping, and depression were sparse and limited. There was a gap in the literature which lead to identifying a health disparities issue in this population. This lack of studies constituted a gap which needed to be further explored. Although self-care involved individual decision making, race/ethnicity and culture played an important role in self-care management (Sorkin et al., 2011). Culturally appropriate treatment was often not utilized effectively for racial/ethnic minority populations with diabetes who were diagnosed with depression, so these patients were often left with sub-optimal care (Sorkin et al., 2011). Utilizing large national data sets to further

explore the racial and ethnic relationship with perceived health, self-care, healthy coping, and depression will add to the body of literature and address the gap in this area of health disparities research.

Purpose

The purpose of the study was to explore if race/ethnicity of people with diabetes was associated with perceived health independent of self-care, healthy coping, and depression, and to further examine the racial/ethnic differences of people with diabetes in the strength of the associations of self-care, healthy coping, and depression with perceived health.

Definitions

Definitions for race/ethnicity, perceived health, self-care, healthy coping, and depression are defined below.

Race/Ethnicity

The Office of Management and Budget (1997) defined the five race categories as: White, Black or African American, American Indian or Alaska Native, Asian - having origins in the Far East, Southeast Asia, and the Indian subcontinent, including countries such as China, Japan, Korea, Thailand, Vietnam, India - and Hispanic or Latino was defined as an ethnicity (Office of Management and Budget, 1997). The public has been conditioned to view race as based on visible physical differences, when in reality, racial groupings differ in only 6% of their genes (American Anthropological Association, 1998).

Race is a mode of classification and ideology with a strategy to divide, rank, and control (American Anthropological Association, 1998). Race is a world view which includes myths about the abilities, physical features, and behaviors of persons and which implies that they are genetically determined (American Anthropological Association, 1998).

Whereas race is based on physical features and genetics, ethnicity is learned. Related to race is ethnicity. In 1978, Ronald Cohen of the Departments of Anthropology and Political Science at Northwestern University in Evanston, Illinois wrote an article titled "Ethnicity: Problem and Focus in Anthropology." In Cohen's article, ethnicity is defined in sociology as having a set of common sociocultural features including customs, language, religion, and values (Cohen, 1978). In anthropology, ethnicity includes sharing cultural values, communication, and interaction (Cohen, 1978). The ethnic group in anthropology is a group of individuals who have shared values and interests (Cohen, 1978).

Perceived Health

Perceived health is a subjective assessment a person makes about their overall health status (Al-Mandhari, Al-Zakwani, Al-Hasni, & Al-Sumri, 2011). It is called self-rated health (Alonso et al., 2013) and an indicator of general health and well-being (Jang et al., 2009). The AADE7 does not include perceived health, however does discuss 'being healthy' (American Association of Diabetes Educators, 2017).

Self-Care

Self-care includes five key areas; healthy eating, being active, monitoring, taking medication, and reducing risks (American Association of Diabetes Educators, 2017).

Healthy Coping

Healthy coping are ways to deal with stress (American Association of Diabetes Educators, 2017). Healthy coping includes exercise, hobbies, faith-based activities, meditation, and having a support network (American Association of Diabetes Educators, 2017).

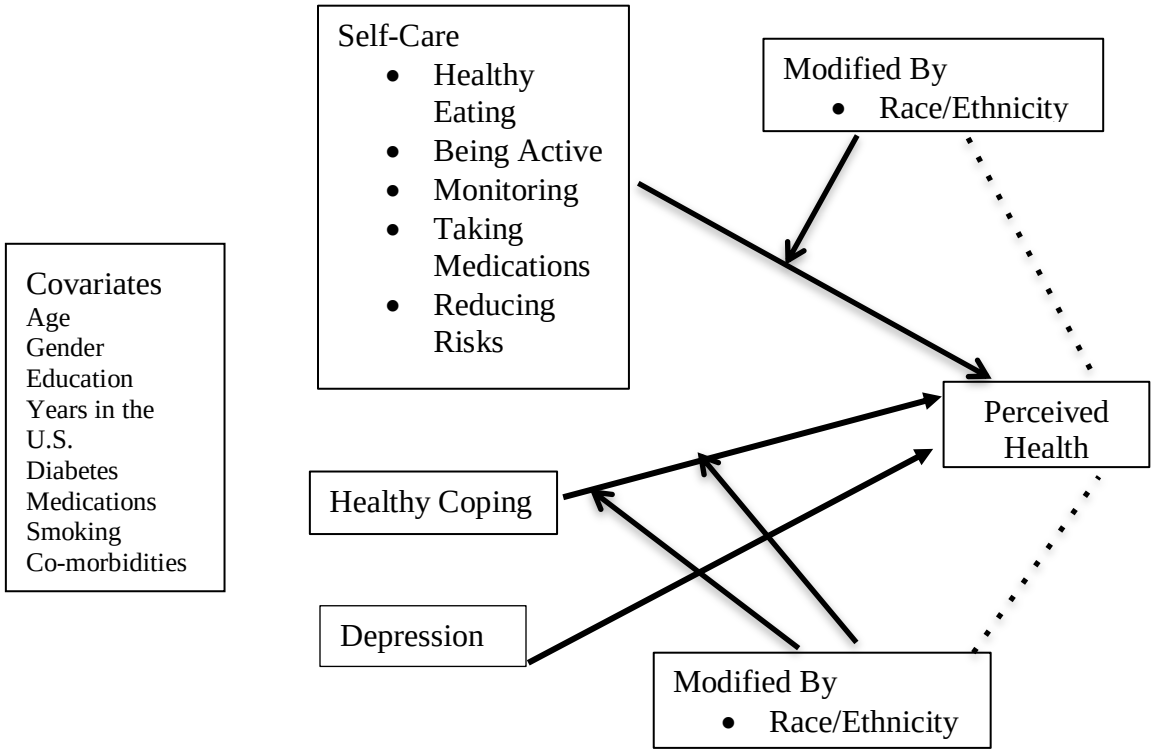
Depression

Depression is described as emotional lows which have an impact on health, life, and relationships. Depression is characterized by lack of interest or pleasure in activities, not wanting to talk to family or friends, sleeping most of the day, and feeling defeated or unable to take care of oneself (American Association of Diabetes Educators, 2017).

Conceptual Model and Conceptual Variables

Figure 1: Adaptation of the AADE7 Self-Care Behaviors Framework to Racial/Ethnic Populations with Diabetes and Perceived Health, Self-Care, Healthy Coping, and Depression

Reference: American Association of Diabetes Educators. (2017). AADE7 Self-Care Behaviors. Retrieved from http://www.diabeteseducator.org/patient-resources/aade7-self-care-behaviors



Self-care, healthy coping, and depression in the conceptual framework were adapted from the AADE7 Self-Care Behaviors framework (American Association of Diabetes Educators, 2017). Six of the seven areas of the AADE7 Self-Care Behaviors framework were adapted to the model based on the research topic. The three areas were self-care (healthy eating, being active, monitoring, taking medication, reducing risks), healthy coping, and depression. Perceived health was the dependent variable and in this study was synonymous with the AADE7 framework of 'being healthy.' The area of self-care healthy eating included eating regular meals, controlling the amount of food eaten, and making a meal plan (American Association of Diabetes Educators, 2017). Being active included physical activity, which was part of a daily lifestyle (American Association of Diabetes Educators, 2017). Monitoring included checking HbA1c, blood pressure, and cholesterol (American Association of Diabetes Educators, 2017). Taking medications included frequency, dose, feelings and side effects while taking the medications, and what to do if a dose is missed (American Association of Diabetes Educators, 2017). Reducing risks included seeing an eye doctor annually, scheduling regular checkups and tests, having a foot exam every year, examining feet for redness and sores, and not smoking (American Association of Diabetes Educators, 2017).

Healthy coping included exercise, enjoyable hobbies, joining a support group, faith-based activities, and meditation (American Association of Diabetes Educators, 2017). Signs of depression included losing interest in activities, feeling unable to take care of oneself, spending most of the day sleeping, and feeling that the presence of diabetes is overpowering (American Association of Diabetes Educators, 2017). Self-care, healthy coping, and depression affects perceived health. Little has been written about the association between race/ethnicity, perceived

health, self-care, healthy coping, and depression. Further testing of this model was done using the NHIS data set from years 2010-2014.

Research Questions

Research Question 1: Is race/ethnicity of persons with diabetes associated with perceived health independent of self-care, healthy coping, and depression?

Research Question 2: Are there racial/ethnic differences of persons with diabetes in the strength of the associations of self-care, healthy coping, and depression with perceived health?

Study Hypotheses

Hypothesis 1: There is an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression.

Hypothesis 2: There are racial/ethnic differences of persons with diabetes in the strength of the associations of self-care, healthy coping, and depression with perceived health.

Summary

The prevalence of diabetes is increasing worldwide. Diabetes includes complications such as cardiovascular disease, retinopathy, nephropathy, and neuropathy. There are higher rates of diabetes in racial/ethnic minority populations compared to non-Hispanic Whites. There is a lack of studies on racial/ethnic minority populations with diabetes and how they perceive their health and the relationship between self-care, healthy coping, and depression, leading to identification of a health disparity issue. This health disparity issue will be further explored in this study.

CHAPTER 2. REVIEW OF THE LITERATURE

Chapter 2 presented a systematic literature review analyzing studies addressing racial/ethnic populations with diabetes and perceived health, self-care, healthy coping, and depression. Conducting the review allowed the researcher to identify gaps in the existing literature.

Systematic Literature Review

A systematic literature review was conducted using PRISMA (Moher, Liberati, Tetzlaff, & Altman, 2009), the key terms included perceived health (in the title), diabetes, and adult, published between 2005 and 2018. Journal articles were limited to English and peer-reviewed. One hundred records were identified through database searching. Twenty-two duplicates were removed. Seventy-eight records were screened and 49 records were excluded after reading title/abstract. Twenty-nine full text articles were assessed for eligibility with 13 studies excluded for having no diabetes (eight studies) or no perceived health (five studies). A total 16 studies which included 15 quantitative studies and one qualitative study were selected.

Of the 15 quantitative studies, five studies were done in the United States including the entire US (Glover, Bellinger, Bae, Rivers, & Singh, 2010; Lange & Piette, 2005), Florida (Huffmann et al., 2013; Jang et al., 2009), and Pennsylvania (Song & Lee, 2009). One study was qualitative and done in San Francisco (Chun et al., 2011). Studies were done internationally in countries such as Oman (Al-Mandhari et al., 2011), Sweden (Al-Windi, 2005), Spain (Alonso et al., 2013), Netherlands (Boot, Koppes, Van den Bossche, Anema, & van der Beek, 2011; Hart, Redekop, Bilo, & Meyboom-de Jong, 2005), Italy (Giuli et al., 2014; Manuti, Rizza, Pileggi, Bianco, & Pavia, 2013), Norway (Iversen et al., 2009), the UK (Ozcan et al., 2014), and Turkey

(Kartal & Inci, 2011). The studies were published between 2005 (Al-Windi, 2005; Hart et al., 2005; Lange & Piette, 2005) and 2014 (Giuli et al., 2014; Ozcan et al., 2014).

Purpose

The purpose of the studies ranged from assessing the impact of diabetes and hypertension on perceived health (Al-Mandhari et al., 2011), to longitudinal measurement of perceived health over a specific length of time (Hart et al., 2005; Jang et al., 2009). Studies included diabetes control (Kartal & Inci, 2011; Lange & Piette, 2005), self-care maintenance (Song & Lee, 2009), and suboptimal control (Ozcan et al., 2014). Studies focused on diabetes and multiple chronic conditions (Alonso et al., 2013; Boot et al., 2011; Glover et al., 2010) including foot ulcer (Iversen et al., 2009), and obesity (Giuli et al., 2014). Some studies focused on only one ethnic group (Chun et al., 2011; Huffmann et al., 2013) or a specific geographical area (Al-Windi , 2005; Manuti et al., 2013).

Theory/framework

There were no theory/frameworks in the 16 studies.

Sample

Sample characteristics. Age, gender, and race/ethnicity were the sample characteristics.

Age. Mean age ranged from 38 (Hart et al., 2005) to 69 years of age (Giuli et al., 2014).

Gender. Among the reviewed studies, there were almost equal numbers of male and female participants (Boot et al., 2011), majority female (Al-Mandhari et al., 2011; Al-Windi, 2005; Chun et al., 2011; Giuli et al., 2014; Glover et al., 2010; Huffmann et al., 2013; Iversen et al., 2009; Jang et al., 2009; Kartal et al., 2011; Manuti et al., 2013; Ozcan et al., 2014), majority male (Hart et al., 2005; Lange & Piette, 2005), and not available (Alonso et al., 2013; Song & Lee, 2009).

Race/ethnicity. Race/ethnicity was not available in nine international studies (Al-Mandhari et al., 2011; Alonso et al., 2013; Boot et al., 2011; Giuli et al., 2014; Hart et al., 2005; Kartal et al., 2011; Manuti et al., 2013; Ozcan et al., 2014). There was a single race/ethnicity such as Chinese (Chun et al., 2011) and Korean (Jang et al., 2009), multiple race/ethnicities including White, African American, Asian, and Hispanic (Glover et al., 2010), Haitian American and African American (Huffmann et al., 2013), White/Caucasian, Hispanic/Latino, and Other (Lange & Piette, 2005), and White, Black, and Others (Song & Lee, 2009).

Sample size. Sample size in quantitative studies ranged from 141 (Jang et al., 2009) to 65,126 (Iversen et al., 2009). A qualitative study on Chinese American persons with diabetes had a sample size of 19 (Chun et al., 2011).

Sampling. All 16 studies used convenience sampling (Al-Mandhari et al., 2011; Al-Windi, 2005; Alonso et al., 2013; Boot et al., 2011; Chun et al., 2011; Giuli et al., 2014; Glover et al., 2010; Hart et al., 2005; Huffmann et al., 2013; Iversen et al., 2009; Jang et al., 2009; Kartal et al., 2011; Lange & Piette, 2005; Manuti et al., 2013; Ozcan et al., 2014; Song & Lee, 2009).

Methods/Study Design

Types of studies included cross-sectional studies (Al-Mandhari et al., 2011; Al-Windi, 2005; Alonso et al., 2013; Boot et al., 2011; Giuli et al., 2014; Glover et al., 2010; Huffmann et al., 2013; Iversen et al., 2009; Kartal et al., 2011; Lange & Piette, 2005; Manuti et al., 2013; Ozcan et al., 2014), longitudinal studies (Hart et al., 2005; Jang et al., 2009), and secondary data analysis (Song & Lee, 2009). The qualitative study was conducted using interpretive comparative interview (Chun et al., 2011).

Related Measures

Perceived health. Perceived health was treated as a dependent variable and measured with a one-item question (Al-Windi, 2005; Boot et al., 2011; Chun et al., 2011; Iversen et al., 2009; Jang et al., 2009; Kartal & Inci, 2011; Lange & Piette, 2005; Song & Lee, 2009) or measured using an instrument such as the SF-12 (Al-Mandhari et al., 2011; Manuti et al., 2013), SF-36 (Giuli et al., 2014), EurQoL-Health Status Measure (Hart et al., 2005; Oczan et al., 2014), or Visual Analog Scale (Alonso et al., 2013), RAND-36 (Hart et al., 2005), EQ-5D and EQ-VAS (Hart et al., 2005).

Race/ethnicity. Race/ethnicity was reported in eight U.S. studies and treated as an independent variable (Chun et al., 2011; Glover et al., 2010; Huffmann et al., 2013; Jang et al., 2009; Lange & Piette, 2005; Song & Lee, 2009). There was a single race/ethnicity such as Chinese (Chun et al., 2011) and Korean (Jang et al., 2009), multiple race/ethnicities including White, African American, Asian, and Hispanic (Glover et al., 2010), Haitian American and African American (Huffmann et al., 2013), White/Caucasian, Hispanic/Latino, and Other (Lange & Piette, 2005), White, Black, and Others (Song & Lee, 2009).

Self-care. Self-care was mentioned in three studies and treated as an independent variable (Alonso et al., 2013; Ozcan et al., 2014; Song & Lee, 2009). Self-care was measured by item questions on dressing, hygiene, eating, and living alone from the (World Health Organization Disability Assessment Schedule 2.0 (WHODAS)) (Alonso et al., 2013), Song and Lee (2009) included questions on dental visits, diet, and exercise. Ozcan et al. (2014) had questions on hypoglycemia awareness using the Gold Hypoglycemic Screening Tool.

Healthy coping. Social support was treated as an independent variable and was measured with the Lubben Social Network Scale (LSNS) (Giuli et al., 2014) and healthy coping was also

mentioned in interviews about interacting with family, food choice, activity choices (Chun et al., 2011).

Depression. Depression was included in five of the studies as an independent variable measured by questionnaires including the Primary Care Evaluation of Mental Disorders (PRIME-MD) (Al-Windi, 2005), World Health Organization (WHO) Composite International Diagnostic Interview version 3.0 (CIDI 3.0) (Alonso et al., 2013), and the Hospital Anxiety and Depression Scale (HADS) (Giuli et al., 2014; Iversen et al., 2009). Other instruments included the Center for Epidemiological Studies -Depression Scale (Jang et al., 2009), and the Short Form-12 Health Survey (SF-12) which included the mental component summary (MCS) (Manuti et al., 2013).

Salient Findings

Perceived health. Perceived health was lower in persons with diabetes compared to persons without diabetes (Al-Mandhari et al., 2011; Alonso et al., 2013; Hart et al., 2005; Huffman et al.,2013; Iversen et al., 2009). Perceived health was worse in older age (Iversen et al., 2009; Kartal & Inci, 2011). Participants with a higher education level had significantly better perceived health (Iversen et al., 2009; Kartal & Inci, 2011; Lange & Piette, 2005; Manuti et al., 2013). Perceived health was worse with insulin use (Kartal & Inci, 2011; Lange & Piette, 2005) and in the presence of one or more chronic illnesses (Boot et al., 2011; Hart et al., 2005; Jang et al., 2009; Lange & Piette, 2005; Manuti et al., 2013) including diabetic foot ulcer (Iversen et al., 2009). Smokers were more likely to report poor perceived health (Al-Windi, 2005).

Race/ethnicity. Persons living with diabetes in the United States who self-identified as Black or Other were less likely to report good/excellent perceived health compared to Caucasians (Song & Lee, 2009). Similarly, Korean Americans with an increased number of

chronic conditions including diabetes and depressive symptoms had decreased perceived health (Jang et al., 2009). Persons with diabetes who had decreased perceived health included Chinese Americans (Chun et al., 2011), and Haitian and African Americans (Huffmann et al., 2013). African Americans were more likely to report fair to poor self-rated health than Haitian Americans (Huffman et al., 2013).

Self-care. Self-care included eating a healthy diet, with vegetables and fruits (Song & Lee, 2009; Chun et al., 2011, doing regular exercise (Chun et al., 2011; Kartal et al., 2011; Song & Lee, 2009), and performing home blood glucose testing and having target blood glucose levels (Ozcan et al., 2014). Self-care and diabetes management were improved by going to a Cantonese speaking diabetes educator (Chun et al., 2011).

Perceived health was better in participants who ate four or more servings of fruit and vegetables daily (Song and Lee, 2009), participants who exercised regularly (Kartal & Inci, 2011; Song & Lee, 2009), and in persons with optimal glucose control through home blood glucose testing, the use of target ranges, and awareness of hypoglycemic episodes (Ozcan et al. 2014). Worse perceived health was reported by participants with poor adherence to treatment (Kartal & Inci, 2011).

Healthy eating. Healthy eating had questions on diet including the consumption of fruits and vegetables (Song & Lee, 2009). Fruit and vegetable consumption were categorized into three or less servings a day and four or more servings per day (Song & Lee, 2009). Dietary changes included increasing the consumption of vegetables and decreasing the consumption of meat (Chun et al., 2011). Participants who practiced healthy eating reported better perceived health (Song & Lee, 2009).

Being active. Regular exercise was measured as less than three half-hour sessions per week and three or more half-hour sessions per week (Song & Lee, 2009). Others choose to walk in a park several times a week (Chun et al., 2011. Participants with a history of foot ulcer compared to those without a history of foot ulcer were significantly more likely to perform physical activity less than one hour per week compared to non-diabetic participants (Iversen et al., 2009). Being active improved perceived health (Iversen et al., 2009; Song & Lee, 2009).

Monitoring. Ozcan et al. (2014) used the Gold hypoglycemia screening tool to measure participant hypoglycemia awareness. These participants had a HbA1c between 7% and 8.5% (Ozcan et al., 2014). They performed home blood glucose tests more often than participants with impaired hypoglycemia awareness and had better perceived health (Ozcan et al., 2014).

Taking medications. Taking medications was hindered by access to medical insurance. Inability to qualify for insurance was a barrier to diabetes management (Chun et al., 2011).

Reducing risk. Reducing risk included stopping smoking and visiting healthcare providers regularly. Smokers reported lower perceived health than non-smokers (Al-Windi, 2005). Participants reduced risk by having had access to a PCP and specialist visits within the past year (Manuti et al., 2013). Participants who reduced their risk such as smoking and visiting the doctor had better perceived health (Al-Windi, 2005; Song & Lee, 2009).

Healthy coping. Healthy coping included social support and physical activity. Healthy coping is important for persons with diabetes because social support is needed from family and friends to cope and manage with diabetes (AADE7, 2017).

Social support was discussed by Chun et al. (2011) in comparing social life in China versus the U.S. Selected participants stated they had few friends and relatives in the U.S. whereas in China they would have been socializing with friends (Chun et al., 2011). One wife

described her husband as choosing to stay home rather than going out to meet others (Chun et al., 2011). Part of healthy coping is physical activity. Participants who walked in the park several times a week felt less stressed and able to control their diet better, which led to improved self-care (Chun et al., 2011). Participants perceived that good air quality and medical care in the U.S. allowed people to live longer in the U.S. (Chun et al., 2011).

Depression. Depression decreased perceived health in participants aged 45-64 with symptoms such as stomach pain, back pain, headaches, palpitations, feeling tired, and having trouble sleeping (Al-Windi, 2005). Depression was negatively associated with general health (Giuli et al., 2014) and had a significant role in the decline of perceived health (Jang et al., 2009). The presence of a diabetic foot ulcer significantly worsened depression, and decreased perceived health (Iversen et al., 2009). Depression significantly decreased perceived health (Al-Windi, 2005; Alonso et al., 2013; Giuli et al., 2014; Iversen et al., 2009; Jang et al., 2009; Manuti et al., 2013).

Significance Gaps in the Literature. Based on the existing literature, there is a gap in the literature utilizing a conceptual framework specifically for persons living with diabetes which encompasses self-care, healthy coping, depression, and perceived health. This gap includes an understanding of racial/ethnic minority groups living with diabetes. Furthermore, there is a need to explore health disparities knowledge of U.S. racial/ethnic populations using big data sets of persons living with diabetes.

The researcher utilized the AADE7 Self-Care Behaviors Framework to explore the relationship between self-care, healthy coping, depression, and perceived health. The researcher explored race/ethnicity as a moderator variable in relationship to self-care, healthy coping, and depression with perceived health in persons living with diabetes. The researcher used the NHIS

data from 2010-2014 to explore health disparities to increase knowledge of U.S. racial/ethnic populations using big data sets of persons living with diabetes.

Summary

A systematic literature review was conducted to identify research articles published between years 2005 to 2018. There were 15 quantitative studies and one qualitative study selected. Purpose of the studies included measurement of perceived health over a length of time, diabetes control, and the presence of diabetes with multiple chronic conditions. Mean age of the sample was between 38 and 69 years. The studies included female and male participants with most studies with a majority female participants and one study with a majority of male participants. Race/ethnicity was not included in nine international studies and was included in studies done in the U.S. Sample size ranged from 19 to 65,126. All 16 studies used convenience sampling. Types of studies included cross-sectional, longitudinal, secondary analysis, and interpretive comparative interview. Perceived health was the dependent variable and measured with a question or an instrument. Race/ethnicity, self-care, healthy coping, and depression were independent variables. The salient findings found that perceived health was worse in persons with diabetes, older age, lower education level, insulin use, having one or more chronic illnesses, and smoking. Korean Americans and Chinese ethnicities reported worse perceived health. African Americans reported good perceived health compared to Caucasians and worse perceived health compared to Haitian Americans. Self-care included healthy eating, being active, monitoring, taking medications, and reducing risk. Participants who performed self-care activities reported better perceived health. Healthy coping included social support and physical activity. Depression decreased perceived health.

CHAPTER 3. METHODOLOGY

Chapter 3 includes the methodology of the study. Further discussion of the study design and method, variables, and data analysis will be discussed in this chapter.

Secondary Analysis

Secondary analysis is analysis of data public or private collected by another researcher for other purposes (Boslaugh, 2007; Cheng & Phillips, 2014). The availability of data allows the researcher to study high impact research in less time and increases productivity through timely publications (Smith et al., 2011). Secondary data sets provide access to large sample sizes and longitudinal data which would otherwise be cost prohibitive (Smith et al., 2011). Suggestions for secondary data analysis include determining the research question by looking at the existing data files (Smith et al., 2011). The researcher should first have a question in mind prior to looking at existing data (Chen & Phillips, 2014; Smith et al., 2011).

Secondary data analysis was performed using the National Health Interview Survey. The NHIS is a major data collection program from the National Center for Health Statistics (NCHS), part of the Centers for Disease Control (CDC) (CDC, 2018) in response to the National Health Survey Act of 1956 to secure accurate and current statistical information on the amount, distribution, and effects of illness and disability in the United States. This cross-sectional household interview survey provides data on a broad range of health topics (CDC, 2018).

National Health Interview Survey Sample

To use the NHIS data a research proposal was submitted using the forms provided online to the National Center for Health Statistics (NCHS) Research Data Center (RDC) (CDC, 2011; CDC, 2018). Creating the data dictionary required identifying variable location, variable name, and variable description (CDC, 2011; CDC, 2018). Since only public-use data sets were used in

the study, which were available via download from the NCHS website, the researcher was informed by the RDC that the RDC did not need a research proposal as no restricted data was used. Only persons with diabetes were included in the study.

Sampling method. Variables from the NHIS from years 2010-2014 were extracted. The sample included (a) persons with diabetes and (b) age 18 to 79. Participants who answered the question on perceived health was included. The following is the breakdown of sample size: The sample size was initially n=138,793. After keeping only persons with diabetes, the sample decreased to n=14,191. Keeping age 18-79 further decreased the sample to n=12,696. The researcher used only participants with complete data on Perceived Health, n=12,671. Twenty-five individuals had missing data on perceived health.

Power analysis. According to the landmark article by Peduzzi, Concato, Kemper, Halford, and Feinstein (1996) on the number of events per variable in logistic regression analysis, the recommendation was to use at least 10 events per variable. The alpha value was 0.05, which was the significance level of the test or p-value. Alpha is the probability of rejecting the null hypothesis even if it is true (McDonald, 2014). Power is the ability of a test to detect an effect of a particular size and the most common value is .80 (Field, 2009). It is also the probability of rejecting the null hypothesis, obtaining a significant result, when the real difference is equal to the minimum effect size (McDonald, 2014). The effect size is also the minimum deviation from the null hypothesis that will be detected (McDonald, 2014). The effect sizes include 0.10 small, 0.30 medium, and 0.50 large (Faul, Erdfelder, Buchner, & Lang, 2009). Statistical power depends on effect size, sample size, and significance level (Cohen, 1992).

An a priori analysis using G*Power with a power of .80, alpha of 0.05, showed the need for a sample size of 343. With a sample size of 343, the actual power was 0.8000012 and the effect size was 0.1499830 (Faul et al., 2009). Thus, a sample of 343 was needed for this study.

Measurements

The variables for this study included demographics (race/ethnicity and covariates), perceived health, self-care, healthy coping, and depression. These questions were selected by comparing the AADE7 Self-Care Behaviors to questions which corresponded to the NHIS variables. Four external reviewers debated and concurred on face and content validity over the course of one year. The researcher focused on data for better and worse perceived health. Better or worse were considered positive-negative responses to a polar question (Servidio, Bocci, & Bianchi, 2018). The question was 'compared with 12 months ago, would you say your health is better, worse, or about the same?'

Procedure. Research questions were selected by reading the AADE7 framework descriptions and finding the NHIS questions which best fit. There were multiple meetings where the researcher met with four external reviewers to discuss the selected variables, add or delete variables, and discuss results over the course of one year. The researcher and reviewers addressed face and content validity and reliability using the AADE7 concepts. A total of 37 variables were selected from the NHIS data set with perceived health= 1 question, 15 questions on self-care with subscores (healthy eating=3; being active=2; monitoring=3; taking medications=3; reducing risks=4), healthy coping=2 questions, and depression=3 questions. Variables were recoded in the same direction and worse was represented by a higher number. The eleven recoded variables included perceived health (1 variable), self-care healthy eating (3 variables), and self-care taking medications (3 variables).

The AADE7 and NHIS Variables

Face and content validity and reliability were addressed among the four external reviewers and researcher using the AADE7 concepts and NHIS questions. The adapted AADE7 framework included perceived health, self-care, healthy coping, and depression. Self-care included 5 subareas including healthy eating, being active, monitoring, taking medications, and reducing risks. The NHIS questions selected had both face and/or content validity for the AADE7 concepts.

The AADE7 does not include perceived health, however does discuss 'being healthy' in regards to self-care, healthy coping, and depression. There was a one-item NHIS question on perceived health which was used to reflect the AADE7 description of 'being healthy.'

For self-care healthy eating, there were three NHIS questions that related to the AADE7 face and content validity for food 'measuring the amount of a serving by the plate method of meal planning.' However, there were no NHIS questions related to face and content validity to the AADE7 concepts of 'reading food labels', 'counting carbohydrates', and 'measuring the amount of a serving using the plate method.'

For self-care being active, there were two NHIS questions which related to the AADE7 face and content validity for being active to read 'have initial duration of 10 minutes with a goal of 30 minute sessions 5 times a week'. The researcher adapted this AADE7 question to read 'have an initial duration of 10 minutes in a week.' The two NHIS questions related to being active were 'How often do you do vigorous leisure-time physical activity for at least 10 minutes that cause heavy sweating or large increases in breath or heart rate?' and 'How often do you do light or moderate leisure-time physical activities for at least 10 minutes that cause only light sweating or a slight to moderate increase in breaths or heart rate?' There were no NHIS questions

related face and content validity for the AADE7 concepts of ‘get the body moving such as walking or going to the gym, or allows the participant to have a conversation during the exercise.’

For self-care monitoring there were three NHIS questions that related to the AADE7 face and content validity for ‘monitoring with the healthcare team blood sugar, blood pressure, cholesterol, kidney, eyes, and feet.’ However, there were no NHIS questions related to face and content validity for the AADE7 concepts of ‘knowing how to use a glucometer’, ‘when to check blood sugar’, and ‘interpreting the numbers.’

For self-care taking medications, there were four NHIS questions that related to the AADE7 face and content validity for taking medications ‘dose’ and ‘frequency.’ However, there were no NHIS questions related face and content validity of the AADE7 concepts for ‘understanding why the medication was recommended’, ‘feelings and side effects of taking the medications’, and ‘what to do if a dose is missed.’

For self-care reducing risks, there were four NHIS questions that related to the AADE7 face and content validity for reducing risks ‘seeing the eye doctor annually’, ‘having a foot exam every year’, ‘scheduling regular medical checkups including dental visits’, and ‘not smoking.’ However, there were no NHIS questions related face and content validity to the AADE7 concepts ‘examining feet for redness’, ‘soreness’, ‘keeping feet clean and dry’.

For healthy coping, there were two NHIS questions that related to the AADE7 face and content validity for healthy coping, ‘enjoyable hobbies’ and ‘joining a support group.’ However, there were no NHIS questions related face and content validity of the AADE7 concepts ‘faith based activities’, ‘exercise’, and ‘meditation.’

For depression, there were three NHIS questions that related to the AADE7 face and content validity for depression 'losing interest in activities', 'feeling unable to take care of oneself', and 'feeling that diabetes is overpowering them.' However, there were no NHIS questions related face and content validity of the AADE7 concepts 'spending most of the day sleeping.'

Demographics. The demographic variables were race/ethnicity (RACERP12 and HISPAN_I), age (AGE_P), male or female (SEX), education (FM_EDUC1), years in the U.S. (YRSINUS), diabetes (DIABAGE, INSLIN, DIBPILL), and smoking (SMKNOW, SMKQTNO). Race/ethnicity in the variable RACERP12 had the variable labels White only, Black/African American only, American Indian/Alaska Native only, Asian only, Race group not releasable, and Multiple race. Race/ethnicity in the variable HISPAN_I had the variable labels multiple Hispanic, Puerto Rico, Mexican, Mexican-American, Cuban/Cuban American, Dominican (Republic), Central or South American, Other Latin American, type not specified, and Other Spanish.

Table 1

Demographics

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
Age	How old are you?	AGE_P	00=under 1 year 01-84=1-84 years 85=85+ years	Continuous
Gender	Are you male or female?	SEX	1=Male 2=Female	Categorical

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
Race	Recode of full detail race groups	RACERPI2	01=White only 02=Black/African American only 03=American Indian/Alaska Native only 04=Asian only 05=Race group not releaseable due to respondent confidentiality or other reason 06=Multiple race	Categorical
Hispanic	Hispanic origin or ancestry	HISPAN_I	00=Multiple Hispanic 01=Puerto Rico 02=Mexican 04=Cuban/Cuban American 05=Dominican (Republic) 06=Central or South American 07=other Latin American, type not specified 08=Other Spanish	Categorical

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
			09=Hispanic/Latino/ Spanish, non-specific type 10=Hispanic/Latino/ Spanish, type refused 11=Hispanic/Latino/ Spanish, type not ascertained 12=not Hispanic/Spanish origin	
Education	What is the highest level of school you have completed or the highest degree you have received?	FM_EDUC1	01=less than/equal to 8th grade 02=9-12th grade, no high school diploma 03=GED recipient 04=High school graduate 05=Some college, no degree 06=AA degree, technical or vocational 07=AA degree, academic program	Categorical

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
			08=Bachelor's degree (BA, BS, AB, BBA) 09=Master's, professional, or doctoral degree	
Years in the U.S.	Years in the U.S. All persons not born in the U.S.	YRSINUS	1=less than 1 year 2=1 year, less than 5 years 3=5 years, less than 10 years 4=10 years, less than 15 years 5=15 years or more	Categorical
Diabetes	How old were you when a doctor or other health professional first told you that you had diabetes or sugar diabetes?	DIABAGE	01-84=1-84 years 85=85+ years	Continuous
Insulin	Are you now taking insulin?	INSLIN	1=Yes 2=No	Categorical
Diabetic pills	Are you now taking diabetic pills to lower your blood sugar? These are sometimes called oral agents or	DIBPILL	1=Yes 2=No	Categorical

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
	oral hypoglycemic agents			
Smoke now	Do you now smoke cigarettes every day, some days, or not at all?	SMKNOW	1=Everyday 2=Some days 3=Not at all	Categorical
Quit smoking	How long has it been since you quit smoking cigarettes?	SMKQTNO	01-94=1-94(# of units) 95=95+	Continuous
Hypertension, High blood pressure	Have you ever been told by a doctor or other health professional that you had hypertension, also called high blood pressure?	HYPEV	1=Yes 2=No	Categorical
Coronary heart disease	Have you ever been told by a doctor or other health professional that you had coronary heart disease?	CHDEV	1=Yes 2=No	Categorical
Heart attack	Have you ever been told by a doctor or other health professional that you had a heart attack (also called	MIEV	1=Yes 2=No	Categorical

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
	myocardial infarction)?			
Heart condition, heart disease	Have you ever been told by a doctor or other health professional that you had any kind of heart condition or heart disease?	HRTEV	1=Yes 2=No	Categorical
Stroke	Have you ever been told by a doctor or other health professional that you had a stroke?	STREV	1=Yes 2=No	Categorical
Weak or failing kidneys	During the past 12 months, have you been told by a doctor or other health professional that you had weak or failing kidneys? Do not include kidney stones, bladder infections, or incontinence.	KIDWKYR	1=Yes 2=No	Categorical
Note. Recoded to reflect analysis Recode: Age to 18-49, 50-59, 60-69, 70-79; Race White, Black/African American, Hispanic, Asian; Hispanic all value labels recoded to Hispanic; Education less than high school, high				

Variable name	NHIS question	NHIS Variable name	NHIS Value label	Categorical or continuous
school graduate, some college, college or more; Years in the U.S. born in the U.S, not born in the U.S. and in U.S. less than 15 years, not born in the U.S. and in the U.S. more than 15 years				

Perceived Health. The outcome variable or dependent variable was perceived health (AHSTATYR). AHSTATYR was a one item question which read "Compared with 12 months ago, would you say your health is better, worse, or about the same?" Participants answered better, worse, or about the same. Subscore range was from 1 to 3.

Table 2

Perceived Health

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 1 to 3	Categorical or continuous
Being healthy	Compared with 12 months ago, would you say your health is better, worse, or about the same?	AHSTATYR	1=Better 2=About the same 3=Worse	Categorical

Self-Care

Self-care included healthy eating, being active, monitoring, taking medications, and reducing risk.

Self-care healthy eating. The self-care variables included self-care: healthy eating

(FSHUNGRY, FSLESS, and FSWEIGHT). FSHUNGRY was stated “In the last 30 days, were you ever hungry but didn’t eat because there wasn’t enough money for food?” FSLESS was the question “In the last 30 days, did you ever eat less than you felt you should because there wasn’t enough money for food?” FSWEIGHT was the question “In the last 30 days, did you lose weight because there wasn’t enough money for food?” Participants answered yes or no. The AADE7 self-care behaviors healthy eating (2017) described healthy eating as including making healthy food choices such as ‘reading food labels’, ‘counting carbohydrates’, ‘measuring the amount of a serving by using the plate method of meal planning where half of the plate contains non-starchy vegetables, one fourth contains meat or protein, and one fourth contains starch.’ The NHIS questions selected were the closest to the healthy eating as described by the AADE7 self-care behaviors (2017). Subscore range was from 3 to 6.

Table 3

Self-Care Healthy Eating Variables

AADE7 Concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscre range 3 to 6	Categorical or continuous
Measuring the amount of a serving by the plate method of meal planning	In the last 30 days, were you ever hungry but didn’t eat because there wasn’t enough money for food?	FSHUNGRY	1=No 2=Yes	Continuous
Measuring the amount of	In the last 30 days, did you ever eat less than you felt you should	FSLESS	1=No 2=Yes	Continuous

AADE7 Concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscre range 3 to 6	Categorical or continuous
a serving by the plate method of meal planning	because there wasn't enough money for food?			
Measuring the amount of a serving by the plate method of meal planning	In the last 30 days, did you lose weight because there wasn't enough money for food?	FSWEIGHT	1=No 2=Yes	Continuous
Reading food labels	None	None	None	None
Counting carbohydrates	None	None	None	None

Self-care being active. Self-care: being active variables were VIGTP and MODTP. VIGTP was stated 'How often do you do vigorous leisure-time physical activity for at least 10 minutes that cause heavy sweating or large increases in breath or heart rate?' MODTP was stated 'How often do you do light or moderate leisure-time physical activities for at least 10 minutes that cause only light sweating or a slight to moderate increase in breath or heart rate?' Participants answered never, per day, per week, per month, or per year. Subscore range was 0 to 8.

Table 4

Self-Care Being Active Variables

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 0 to 8	Categorical or continuous
Have an initial duration of 10 minutes in a week	How often do you do vigorous leisure-time physical activity for at least 10 minutes that cause heavy sweating or large increases in breath or heart rate?	VIGTP	0=Never 1=Per day 2=Per week 3=Per month 4=Per year	Continuous
Have an initial duration of 10 minutes in ia week	How often do you do light or moderate leisure-time physical activities for at least 10 minutes that cause only light sweating or a slight to moderate increase in breaths or heart rate?	MODTP	0=Never 1=Per day 2=Per week 3=Per month 4=Per year	Continuous
Get the body moving such as walking or going to the gym	None	None	None	None
Allows the participant to have a conversation during exercise	None	None	None	None

Self-care monitoring. Self-care-monitoring variables were APSCHCHK, APSBSCHK, and APSBPCHK. APSCHCHK was the question "During the past 12 months, have you had your cholesterol checked by a doctor, nurse, or other health professional?" APSBSCHK was the question "Have you had a fasting test for high blood sugar or diabetes during the past 12 months?" APSBPCHK was the question "During the past 12 months, have you had your blood pressure checked by a doctor, nurse, or other health professional?" Participants answered 'yes' or 'no'. The AADE7 self-care behaviors (2017) described monitoring with the participant as 'knowing how to use a glucometer', 'when to check blood sugar', 'interpreting the numbers', and 'monitoring with the healthcare team blood sugar, blood pressure, cholesterol, kidney, eyes, and feet.' The subscore range was 3 to 6.

Table 5

Self-care Monitoring Variables

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 3 to 6	Categorical or continuous
Monitoring with the healthcare team blood sugar, blood pressure, cholesterol, kidney, eyes, and feet	During the past 12 months, have you had your cholesterol checked by a doctor, nurse, or other health professional?	APSCHCHK	1=Yes 2=No	Continuous
Monitoring with the healthcare team blood sugar, blood pressure,	Have you had a fasting test for high blood sugar or diabetes during the past 12 months?	APSBSCHK	1=Yes 2=No	Continuous

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 3 to 6	Categorical or continuous
cholesterol, kidney, eyes, and feet				
Monitoring with the healthcare team blood sugar, blood pressure, cholesterol, kidney, eyes, and feet	During the past 12 months, have you had your blood pressure checked by a doctor, nurse, or other health professional?	APSBPCHK	1=Yes 2=No	Continuous
Know how to use a glucometer	None	None	None	None
When to check blood sugar	None	None	None	None
Interpreting the numbers	None	None	None	None

Self-care taking medications. Self-care: taking medications variables were AHACAFY_1, ARXPR_1, and ARXPR_2. AHACAFY_1 was the question "During the past 12 months, were there any time when you needed the following, but didn't get it because you couldn't afford it…prescription medicines?" ARXPR_1 was the question "During the past 12 months are any of the following true for you? "You skipped medication doses to save money." ARXPR_2 was the question "During the past 12 months, are any of the following true for you? You took less medicine to save money." Participants answered 'yes' or 'no'. The AADE7 self-care behaviors (2017) described taking medication as 'understanding why the medication was

recommended', 'dose', 'frequency', 'feelings and side effects while taking the medications', and 'what to do if a dose is missed.' The subscore range was 3 to 6.

Table 6

Self-Care Taking Medications Variables

AADE7 concept and subconcept	NHIS question	NHIS Variable name	NHIS Value label Subscore range 3 to 6	Categorical or continuous
Frequency	During the past 12 months, were there any time when you needed the following, but didn't get it because you couldn't afford it…prescription medicine?	AHCAFY_1	1=No 2=Yes	Continuous
Dose	During the past 12 months are any of the following true for you? You skipped medication doses to save money.	ARXPR_1	1=No 2=Yes	Continuous
Dose	During the past 12 months, are any of the following true for you? You took less medicine to save money.	ARXPR_2	1=No 2=Yes	Continuous
Understanding why the medication was recommended	None	None	None	None
Feelings and side effects while taking	None	None	None	None

AADE7 concept and subconcept	NHIS question	NHIS Variable name	NHIS Value label Subscore range 3 to 6	Categorical or continuous
the medications				
What to do if a dose is missed	None	None	None	None

Self-care reducing risks. Self-care-reducing risks variables were AHCSY1_2, ACHSY1_3, APSDIET, and CIGQTYR. AHCSY1_2 was the question "During the past 12 months, have you seen or talked to any of the following health care providers about your own health? An optometrist, ophthalmologist, or eye doctor (someone who prescribes eye glasses)". AHCSY1_3 was the question "During the past 12 months, have you seen or talked to any of the following health care providers about your own health? A foot doctor…" APSDIET was the question "During the past 12 months, has a doctor or other health professional talked to you about your diet?" CIGQTYR was the question "During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking?" Participants answered 'yes' or 'no'. The AADE7 self-care behaviors reducing risks described reducing risks as not 'smoking', 'seeing the eye doctor annually', 'scheduling regular medical checkups including dental visits', 'examining feet for redness, sores', 'keeping feet clean and dry', and 'having a foot exam every year.' The subscore range was 4 to 8.

Table 7

Self-Care Reducing Risks Variables

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 4 to 8	Categorical or continuous
Seeing the eye doctor annually	During the past 12 months, have you seen or talked to any of the following health care providers about your own health? An optometrist, ophthalmologist, or eye doctor (someone who prescribes eye glasses)	AHCSY1_2	1=Yes 2=No	Continuous
Having a foot exam every year	During the past 12 months, have you seen or talked to any of the following health care providers about your own health? A foot doctor	AHCSY1_3	1=Yes 2=No	Continuous
Scheduling regular medical checkups including dental visits	During the past 12 months, has a doctor or other health professional talked to you about your diet?	APSDIET	1=Yes 2=No	Continuous
Not smoking	During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking?	CIGQTYR	1=Yes 2=No	Continuous
Examining feet for	None	None	None	None

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 4 to 8	Categorical or continuous
redness, sores				
Keeping feet clean and dry	None	None	None	None

Healthy coping. The independent variable healthy coping included questions (FLRELAX, FLSOCL). FLRELAX was the question "By yourself, and without using any special equipment, how difficult is it for you to…Do things to relax at home or for leisure (reading, watching TV, sewing, listening to music)?" FLSOCL was the question "By yourself, and without using any special equipment, how difficult is it for you to…Participate in social activities such as visiting friends, attending clubs and meetings, going to parties?" Participants answered 'not at all difficult', 'only a little difficult', 'somewhat difficult', 'very difficult', or 'can't do at all' or 'did not do this activity.' The AADE7 Self-care behaviors (2017) described healthy coping as participation in 'faith-based activities', 'exercise', 'meditation', 'having enjoyable hobbies', and 'joining a support group.' The subscore range was 0 to 12.

Table 8

Healthy Coping Variables

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 0 to 12	Categorical or continuous
Enjoyable hobbies	By yourself, and without using any special equipment, how difficult is it for you to do things to relax at home or for leisure (reading, watching tv, sewing, listening to music)?	FLRELAX	0=Not at all difficult 1=Only a little difficult 2=Somewhat difficult 3=Very difficult 4=Can't do at all 6=Did not do this activity	Continuous
Joining a support group	By yourself, and without using any special equipment, how difficult is it for you to participate in social activities such as visiting friends, attending clubs and meetings, going to parties?	FLSOCL	0=Not at all difficult 1=Only a little difficult 2=Somewhat difficult 3=Very difficult 4=Can't do at all 6=Did not do this activity	Continuous
Faith based activities	None	None	None	None
Exercise	None	None	None	None

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 0 to 12	Categorical or continuous
Meditation	None	None	None	None

Depression. Independent variables on depression were (HOPELESS, EFFORT, and WORTHLS). The variable name HOPELESS was worded "Over the past 30 days, how often do you feel hopeless?" The variable name EFFORT was worded "Over the past 30 days, how often do you feel that everything was an effort?" The variable name WORTHLS was worded "Over the past 30 days, how often do you feel worthless?" Participants answered 'none of the time', 'a little of the time', 'some of the time', 'most of the time', or 'all of the time.'

The AADE7 Self-Care Behaviors (2017) described signs of depression as 'losing interest in activities', 'feeling unable to take care of oneself', 'spending most of the day sleeping', and 'feeling that diabetes is overpowering them.' The subscore range was 3 to 15.

Table 9

Depression Variables

AADE7 concepts and subconcepts	NHIS question	NHIS Variable name	NHIS Value label Subscore range 3 to 15	Categorical or continuous
Losing interest in activities	Over the past 30 days, how often do you feel hopeless?	HOPELESS	1=none of the time 2=a little of the time	Continuous

			3=some of the time 4=most of the time 5=all of the time	
Feeling unable to take care of oneself	Over the past 30 days, how often do you feel that everything was an effort?	EFFORT	1=none of the time 2=a little of the time 3=some of the time 4=most of the time 5=all of the time	Continuous
Feeling that diabetes is overpowering them	Over the past 30 days, how often do you feel worthless?	WORTHLS	1=none of the time 2=a little of the time 3=some of the time 4=most of the time 5=all of the time	Continuous
Spending most of the day sleeping	None	None	None	None

Data Analysis

Analysis was done using SAS 9.4 (SAS Institute Inc., Cary, NC). Selected variables were recoded. Descriptive analysis included frequency, percentage, means, and standard error. Associations/correlations were tested using bivariate analysis including chi-square and univariate logistic regression. Multivariable logistic regression was performed with perceived health as the dependent variable with self-care, healthy coping, and depression as the independent variables. Interaction terms were added to test if there were racial/ethnic differences in the strengths of the associations in perceived health with self-care, healthy coping, and depression. P-value was $p<0.05$, considered statistically significant. All variables and p-values were weighted.

There were two research questions. Research questions 1 and 2 included self-care, healthy coping, depression, perceived health, and race/ethnicity. Additional analysis for research questions 1 and 2 included the covariates.

Statistical Analysis

Statistical models.

Two multinomial logistic regression models were utilized to explore the relationship between the variables. Variables included race/ethnicity, perceived health, self-care, healthy coping, and depression

Regression models –

Research Question 1/Hypothesis 1.

Research Question 1: Is race/ethnicity of persons with diabetes associated with perceived health independent of self-care, healthy coping, and depression?

Hypothesis 1: There is an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression.

Model 1.

Research Question 1/Hypothesis 1: Model 1

Model 1: Perceived Health= self-care+ healthy coping+ depression + Race/Ethnicity

Model 1: Perceived Health= self-care + healthy coping+ depression + Race/Ethnicity1(y/n)+ Race/Ethnicity2 (y/n)+ Race/Ethnicity3 (y/n)+ Race/Ethnicity 4(y/n). Each person was coded yes for one race/ethnicity and no for the others.

The first regression model examined the association between race/ethnicity and perceived health independent of self-care, healthy coping, and depression. Multinomial logistic regression was used with race/ethnicity, perceived health, self-care, healthy coping, and depression. A significant result showed that race/ethnicity was independently associated with perceived health.

Whereas Model 1 looked at the associations between the variables, Model 2 explored the strengths of associations to see if race/ethnicity was a moderating variable, strengthening or weakening the relationship between the independent variables and perceived health.

Research Question 2/Hypothesis 2.

Research Question 2: Are there racial/ethnic differences in the strengths of the associations of self-care, healthy coping, and depression with perceived health?

Hypothesis 2: There are racial/ethnic differences of persons with diabetes in the strengths of the associations of self-care, healthy coping, and depression with perceived health.

Model 2.

Research Question 2/Hypothesis 2: Model 2

Perceived health= self-care + healthy coping + depression +Race/Ethnicity1 + Race/Ethnicity2 + Race/Ethnicity3+ Race/Ethnicity4+ Race/Ethnicity1*self-care+ Race/Ethnicity1*healthy coping +Race/Ethnicity1*depression+Race/Ethnicity2*self-care+ Race/Ethnicity2*healthy

coping+Race/Ethnicity2*depression+Race/Ethnicity3*self-care+ Race/Ethnicity3*healthy coping+Race/Ethnicity3*depression+Race/Ethnicity4*self-care+ Race/Ethnicity4*healthy coping+ Race/Ethnicity4*depression

In Model 2, race/ethnicity was treated as a moderating variable to see if there were race/ethnic differences in the strengths of the associations with perceived health. In this equation, if the interaction between the independent variable (self-care, healthy coping, and depression) and moderator variable (race/ethnicity) was statistically significant, then race/ethnicity was a moderator variable.

According to Baron and Kenny (1986), a moderating variable is a "variable that affects the direction and/or strength of the relation between an independent or predictor variable and dependent or criterion variable." The moderator variable is an independent variable (Baron & Kenny, 1986). While a moderator variable helps show if there is an effect, in comparison, a mediator variable explains how or why an effect occurs (Baron & Kenny, 1986). A moderator variable is introduced "when there is an unexpectedly weak or inconsistent relation between a predictor and a criterion variable." (Baron & Kenny, 1986). Mediation is best done when there is a strong relation between the independent and dependent variable (Baron & Kenny, 1986). In our study, we were not sure of the relationship between the independent and dependent variable, so the researcher wanted to know if there was a relationship and did the moderating variable race/ethnicity affect the strengths of the associations.

Additional Analysis research questions 1 and 2

Additional analysis for research questions 1 and 2 included the covariates. The covariates were age, gender, education, years in the U.S., medications, smoking, and co-morbidities.

Model 1 + covariates

The covariates were added to model 1 and analyzed.

Model 2 + covariates + interaction terms

The covariates and interaction terms were added to model 2 and analyzed.

Model 2 + covariates + interaction terms by race/ethnicity

The covariates were added to model 2 and the interaction terms by race/ethnicity were analyzed. In addition, Black/African American and Asians were further analyzed separately.

Human Subjects

An application for exempt status for Human Subjects Research was submitted to the University of Hawaii Human Studies Program. The category for exemption was Federal Category 4 in which the study of existing data was collected in the past and publicly available. CHS # 23442 was approved on October 7, 2015 and does not expire.

Summary

Secondary data analysis was performed using the National Health Interview Survey (NHIS) National Center for Health Statistics (NCHS) from years 2010-2014. The sample size was 12, 671. The variables of interest included race/ethnicity, perceived health, self-care, healthy coping, and depression. There were two research questions/hypotheses. Model 1 explored the association of race/ethnicity of persons with diabetes associated with perceived health independent of self-care, healthy coping, and depression. Model 2 explored racial/ethnic differences in the strengths of the associations of self-care, healthy coping, and depression with perceived health. Additional analysis for research questions 1 and 2 were completed and included the covariates and interaction terms. This study was approved by the University of Hawaii Human Studies Program (CHS # 23442).

CHAPTER 4. RESULTS

In chapter 4, the results are presented in table and narrative form. Results include descriptive statistics, correlations, multivariable logistic regression, and interaction terms between race and other independent variables.

The covariates included age, gender, education, years in the U.S., medications, smoking, and co-morbidities. The dependent variable was perceived health. The main independent variables were self-care, healthy coping, and depression. Race/ethnicity was also analyzed as an independent and moderator variable.

Results

Table 10 displays the descriptive statistics of the overall study sample and included frequencies, percentages, means, and standard error of race/ethnicity, perceived health, self-care, healthy coping, depression, and covariates.

Table 10

Descriptive Statistics of the Overall Study Sample (n=12,671)

Variable	N	%	Mean ± SE	Missing
Age in years				0
18-49	2,564	22.6		
50-59	3,164	26.3		
60-69	4,069	31.3		
70-79	2,874	20.1		
Gender				0
Male	5,879	50.1		
Female	6,792	49.9		
Race/ethnicity				242
White	6,774	62.2		

-continued Table 10

Variable	N	%	Mean ± SE	Missing
Black/African American	2,625	16.3		
American Indian/Alaska Native	140	1.0		
Hispanic	2,308	16.0		
Asian	582	4.4		
Education				63
Less than high school	2,964	21.1		
High school graduate	3,715	30.2		
Some college	2,296	18.1		
College or more	3,633	30.7		
Years in the US				27
Born in the US	10,307	82.6		
Not born in the US and in US less than 15 years	355	2.8		
Not born in the US and in US more than 15 years	1,982	14.7		
Medications				
Taking diabetic pills				10
Yes	9,080	71.9		
No	3,581	28.1		
Taking insulin				4
Yes	3,839	29.5		

-continued Table 10

Variable	N	%	Mean ± SE	Missing
No	8,828	70.5		
Smoking				6472
Everyday	1,742	27.8		
Some days	438	6.3		
Not at all	4,019	65.9		
Co-morbidities				
Hypertension				9
Yes	9.271	71.4		
No	3,391	28.6		
Coronary heart disease				34
Yes	2,041	15.2		
No	10,596	84.4		
Heart attack				12
Yes	1,490	10.9		
No	11,169	89.1		
Heart condition/disease				10
Yes	2,080	16.2		
No	10,581	83.3		
Stroke				11
Yes	1,135	8.6		
No	11,525	91.4		
Weak/failing kidneys				12
Yes	990	7.0		
No	11,669	93.0		
Self-care				
Unable to afford food			3.83±0.02	

-continued Table 10

Variable	N	%	Mean ± SE	Missing
Being inactive			5.43±0.03	
Unable to monitor Health			3.25±0.01	
Unable to afford medication			3.31±0.01	
Risky behavior			4.84±0.01	
Healthy coping			1.04±0.02	
Depression			4.40±0.03	
Perceived Health				0
Better	2,609	20.5		
Worse	2,176	16.4		
About the same	7,886	63.1		
Note. Weighted percentage; SE = Standard Error				

Table 10 is a presentation of the descriptive statistics of the overall study sample. A total of 12,671 persons with diabetes, aged 18 to 79 years were included in the study. Age was categorized into 18-49 years (22.6%), 50-59 (26.3%), 60-69 (31.3%), and 70-79 (20.1%). There were 50.1% males and 49.9% females. A majority of persons with diabetes were White (62.2%). Other race/ethnicities were Black/African American (16.3%), Hispanic (16.0%), Asians (4.4%), and American Indian/Alaska Natives (1.0%). Education level ranged from less than high school graduates (21.1%), high school graduate (30.2%), with some college (18.1%), and with college education or more (30.7%). A majority of participants were born in U.S. (82.6%). There were 2.8% participants not born in the U.S. and living in the U.S. less than 15 years and 14.7% not born in the U.S. and living in the U.S. 15 years or more.

A majority reported taking diabetic pills (71.9%) with fewer taking insulin (29.5%). Most were non-smokers (65.9%). There were daily smokers (27.8%) and those who smoked some days (6.3%). Co-morbidities included hypertension (71.4%), coronary heart disease (15.2%), heart attack (10.9%), heart condition (16.2%), stroke (8.6%), and weak/failing kidneys (7.0%).

Mean and standard error for self-care in descending order were being inactive (5.43±0.03), risky behavior (4.84±0.01), unable to afford food (3.83±0.02), unable to afford medication (3.31±0.01), and unable to monitor health (3.25±0.01). The mean and standard error for healthy coping was (1.04±0.02) and for depression was (4.40±0.03). Perceived health was reported as better (20.5%), worse (16.4%), and about the same (63.1%).

The results for the correlations, multivariable logistic regression, and interaction terms included only the sample based on 'better' or 'worse' perceived health (n=4,785). The associations between race/ethnicity, perceived health, self-care, healthy coping, depression, and covariates were explored in Table 11.

Table 11

Descriptive Statistics and Bivariate Analysis of the Study Sample by Better or Worse Perceived Health (n=4,785)

Variable	Total (n=4,785) N (weighted %)	Better (n=2,609) N (weighted %)	Worse (n=2,176) N (weighted %)	Weighted P-value	Missing
Age				**0.003**	0
18-49	1,088(24.9)	657(61.0)	431(38.9)		
50-59	1,303(29.2)	680(54.7)	623(45.3)		
60-69	1,477(29.2)	800(54.9)	677(45.1)		

-continued Table 11

Variable	Total (n=4,785) N (weighted %)	Better (n=2,609) N (weighted %)	Worse (n=2,176) N (weighted %)	Weighted P-value	Missing
70-79	917(16.6)	472(50.5)	445(49.5)		
Gender				0.299	0
Male	2,110(47.4)	1,176(56.6)	934(43.4)		
Female	2,675(52.6)	1,433(54.7)	1,242(45.3)		
Race/ethnicity				0.077	117
White	2,481(61.0)	1,334(54.1)	1,147(45.9)		
Black/African American	986(16.6)	555(58.1)	431(41.9)		
American Indian/Alaska Native	52(1.0)	23(44.1)	29(55.9)		
Hispanic	938(17.4)	516(59.1)	422(40.9)		
Asian	211(4.0)	105(52.9)	106(47.1)		
Education				**<0.001**	612
Less than high school	1,173(21.8)	513(43.5)	660(56.5)		
High school graduate	1,323(28.9)	711(54.6)	612(45.4)		
Some college	888(18.2)	515(57.7)	373(42.3)		
College or more	1,375(30.9)	860(64.2)	515(35.8)		
Years in the U.S.				0.560	12
Born in U.S.	3,887(83.4)	2,133(55.6)	1,754(44.4)		

-continued Table 11

Variable	Total (n=4,785) N (weighted %)	Better (n=2,609) N (weighted %)	Worse (n=2,176) N (weighted %)	Weighted P-value	Missing
Not born in U.S. and less than 15 years	143(2.8)	85(61.2)	58(38.8)		
Not born in U.S. and 15 years or more	743(13.8)	387(55.2)	356(44.8)		
Medications					
Taking diabetic pills				0.955	6
Yes	3,278(68.8)	1,795(55.7)	1,483(44.3)		
No	1,501(31.2)	813(55.6)	688(44.4)		
Taking insulin				**<0.001**	0
Yes	1,614(33.0)	777(49.5)	837(50.5)		
No	3,171(66.9)	1,832(58.7)	1,339(41.3)		
Smoking				**<0.001**	2373
Everyday	728(30.1)	306(39.8)	422(60.2)		
Some days	172(6.4)	86(47.2)	86(52.8)		
Not at all	1,512(63.5)	841(57.2)	671(42.8)		
Co-morbidities					
Hypertension				**<0.001**	5
Yes	3,618(73.9)	1,897(53.1)	1,721(46.9)		
No	1,162(26.1)	710(62.8)	452(37.2)		
Coronary heart disease				**<0.001**	22
Yes	935(18.4)	437(49.1)	498(50.9)		

-continued Table 11

Variable	Total (n=4,785) N (weighted %)	Better (n=2,609) N (weighted %)	Worse (n=2,176) N (weighted %)	Weighted P-value	Missing
No	3,828(81.6)	2,163(57.2)	1,665(42.8)		
Heart attack				**<0.001**	9
Yes	672(12.9)	291(44.5)	381(57.3)		
No	4,104(87.1)	2,314(55.5)	1,790(42.7)		
Heart condition/disease				**<0.001**	6
Yes	961(19.8)	432(46.2)	529(57.9)		
No	3,818(80.2)	2,173(57.9)	1,645(42.1)		
Stroke				**0.011**	5
Yes	517(10.3)	241(48.6)	276(51.4)		
No	4,263(89.7)	2,365(56.4)	1,898(43.6)		
Weak/failing kidneys				**<0.001**	6
Yes	525(10.3)	207(38.9)	318(61.1)		
No	4,254(89.7)	2,402(57.6)	1,852(42.4)		
Note. Weighted Row Percentage; Higher mean score is worse.					

Table 11 presents descriptive statistics of the study sample by better or worse perceived health. Better or worse perceived health was selected to see the most dramatic differences between the two groups. There was a total of 4,785 participants who reported better or worse perceived health.

Age was significant (p=0.003) for the difference in perceived health between better and worse. There was a total of 4,785 participants age 18-49 (24.9%), 50-59 (29.2%), 60-69 (29.2%),

and age 70-79 (16.6%). There was a total of 2,609 and 2,176 reporting better or worse perceived health, respectively. Age was divided into the following categories 18-49 better (61.0%) and worse (38.9%), 50-59 better (54.7%) and worse (45.3%), 60-69 better (54.9%) and worse (45.1%), 70-79 better (50.5%) and worse (49.5%). Reporting of worse perceived health increased with age.

Gender was not significant ($p=0.299$). There was a total of males (47.4%) and females (52.6%). A majority of males reported perceived health as better (56.6%) and worse (43.4%), respectively. A majority of females reported perceived health as better (54.7%) and worse (45.3%).

Race/ethnicity was also not significant ($p=0.077$). There were White (61.0%), Black/African American (16.6%), American Indian/Alaska Native (1.0%), Hispanic (17.4%), and Asian (4.0%). Better perceived health was reported by a majority of Whites (54.1%), Black/African Americans (58.1%), Hispanics (59.1%), and Asians (52.9%). A majority of American Indian/Alaska Natives (55.9%) reported worse perceived health. According to the U.S. Census (2017) population estimates, Whites are 76.6%, Black/African American 13.4%, Asians 5.8%, and American Indian/Alaska Native 1.3% of the U.S population.

Education level was significant ($p<0.001$) in perceived health. There were with less than high school education (21.8%), high school graduates (28.9%), with some college (18.2%), and college or more (30.9%). Perceived health was reported by participants who were less than high school better (43.5%) and worse (56.5%), high school graduates better (54.6%) and worse (45.4%), some college better (57.7%) and worse (42.3%), and college or more better (64.2%) and worse (35.8%).

Years in the U.S. was not significant (p=0.560). The years in the U.S. were placed in three categories (a) born in the U.S. (83.4%), (b) not born in the U.S. and living in the U.S. less than 15 years (2.8%), and (c) not born in the U.S. and living in the U.S. 15 years or more (13.8%). Perceived health was reported by participants who were born in the U.S. better (55.6%) and worse (44.4%), not born in the U.S. and living in the US less than 15 years better (61.2%) and worse (38.8%), and not born in the U.S. and living in the U.S. 15 years or more better (55.2%) and worse (44.8%).

Taking diabetic pills was not significant (p=0.955). There were those taking diabetic pills (68.8%) and those who did not (31.2%). Of those who were taking diabetic pills, perceived health was reported as better (55.7%) and worse (44.3%), respectively.

Taking insulin was significant (p<0.001). There were participants taking insulin (33.0%) and those who did not (66.9%). Of those taking insulin, perceived health was reported as better (49.5%) and worse (50.5%).

Smoking was significant (p<0.001). Participants reported smoking everyday (30.1%), some days (6.4%), and not at all (63.5%). Perceived health was reported by everyday smokers as better (39.8%) or worse (60.2%), some days better (47.2%) or worse (52.8%), and not at all better (57.2%) or worse (42.8%).

Co-morbidities were significant and included hypertension (p<0.001), coronary heart disease (p<0.001), heart attack (p<0.001), heart condition/disease (p<0.001), stroke (p=0.011), and weak/failing kidneys (p<0.001). Participants reported having hypertension (73.9%). Hypertensive participants reported perceived health as better (53.1%) or worse (46.9%). Coronary heart disease was reported by 18.4% of the participants. Coronary heart disease participants reported perceived health as better (49.1%) or worse (50.9%). Heart attack was

reported by 12.9% of the participants. Heart attack participants reported perceived health as better (44.5%) or worse (57.3%). Heart condition/disease was reported by 19.8% of participants. Heart condition/disease participants reported perceived health as better (46.2%) or worse (57.9%). Stroke was reported by 10.3% of participants. Stroke participants reported perceived health as better (48.6%) or worse (51.4%). Weak/failing kidneys was reported by 10.3% of participants. Participants with weak/failing kidneys perceived health as better (38.9%) or worse (61.1%).

Associations were further explored with means and standard errors of better or worse perceived health with self-care, healthy coping, and depression.

Table 12

Mean and Standard Error of the Study Sample by Better or Worse Perceived Health (n=4,785)

Variable	Total (Mean ± SE)	Better (Mean ± SE)	Worse (Mean ± SE)	Weighted P-value	Median
Self-care					
Unable to afford food	3.91 ± 0.03	3.82 ± 0.03	3.96 ± 0.03	**0.015**	4.5
Being inactive	5.45 ± 0.06	4.84 ± 0.07	6.26 ± 0.07	**<0.001**	4
Unable to monitor health	3.22 ± 0.01	3.22 ± 0.01	3.23 ± 0.01	0.729	4.5
Unable to	3.46 ± 0.02	3.31 ± 0.02	3.65 ± 0.03	**<0.001**	4.5

afford medication					
Risky behavior	4.79 ± 0.02	4.73 ± 0.03	4.87 ± 0.03	**<0.001**	5.75
Healthy coping	1.46 ± 0.05	0.72 ± 0.04	2.39 ± 0.08	**<0.001**	4.86
Depression	4.91 ± 0.05	4.09 ± 0.05	5.94 ± 0.08	**<0.001**	8.64

Table 12 presents the mean and standard error of the study sample by better or worse perceived health. Means and standard error for the total sample (n=4,785) for self-care included unable to afford food (3.91 ± 0.03), being inactive (5.45 ± 0.06), unable to monitor health (3.22 ± 0.01), unable to afford medication (3.46 ± 0.02), and risky behavior (4.79 ± 0.02). The total sample means and standard errors for healthy coping were (1.46 ± 0.05) and depression (4.91 ± 0.05). Perceived health means and standard errors were self-care unable to afford food (p=0.015) better (3.82 ± 0.03) or worse (3.96 ± 0.03), median 4.5; being inactive (p<0.001) better (4.84 ± 0.07) or worse (6.26 ± 0.07), median 4; unable to monitor health (p=0.729) better (3.22 ± 0.01) or worse (3.23 ± 0.01), median 4.5; unable to afford medication (p<0.001) better (3.31 ± 0.02) or worse (3.23 ± 0.01), median 4.5; and risky behavior (p<0.001) better (4.73 ± 0.03) or worse (4.87± 0.03), median 5.75. Perceived health means and standard errors for healthy coping (p<0.001) better (0.72 ± 0.04) or worse (2.39 ± 0.08), median 4.86; and depression (p<0.001) better (4.09 ± 0.05) or worse (5.94 ± 0.08), median 8.64.

The relationships between the variables were further explored in Table 13, which displays the multivariable logistic regression for Model 1. The table includes the odds ratio and confidence interval of comparing better or worse perceived health.

Research Question 1: Is race/ethnicity of persons with diabetes associated with perceived health independent of self-care, healthy coping, and depression?

Hypothesis 1: There is an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression.

Table 13

Multivariable Logistic Regression Better or Worse Perceived Health (Model 1) (n=4,785)

Variable	OR	95% CI	Weighted P-value
Race/ethnicity			
AI/AN vs White	4.04	[0.76, 21.63]	
Asian vs White	1.67	[0.63, 4.43]	
Black/African American vs White	0.66	[0.46, 0.93]	**<0.05**
Hispanic vs White	0.77	[0.53, 1.11]	
Self-care			
Unable to afford Food	0.05	[0.82, 1.11]	
Being inactive	1.20	[1.13, 1.28]	**<0.001**
Unable to monitor Health	0.92	[0.73, 1.17]	
Unable to afford medication	1.18	[1.04, 1.33]	**<0.05**
Risky behavior	1.18	[1.04, 1.33]	**<0.01**
Healthy coping	1.14	[1.06, 1.21]	**<0.001**
Depression	1.17	[1.10, 1.23]	**<0.001**

Note. AI/AN=American Indian/Alaska Native; U.S.=United States.
Model 1: Perceived Health = Race/Ethnicity + Self-care + Healthy Coping + Depression
*OR > 1 indicates higher odds of 'worse' health status compared to better health status.

Table 13 presents multivariable logistic regression for perceived health (Model 1) and included variables for race/ethnicity independent of self-care, healthy coping, and depression. When comparing better or worse perceived health, Black/African American participants reported significantly better perceived health compared to White participants [OR=0.66, 95% CI (0.46-0.93), $p<0.05$]. In the category of self-care, participants reported significantly worse perceived health in relation to being inactive [OR=1.20, 95% CI (1.13-1.28), $p<0.001$], unable to afford medication [OR=1.18, 95% CI (1.04-1.33), $p<0.05$], and engaging in risky behavior [OR=1.18, 95% CI (1.04-1.33), $p<0.01$]. Participants reported worse perceived health with decreased healthy coping [OR=1.14, 95% CI (1.06-1.21), $p<0.001$], and depression [OR=1.17, 95% CI (1.10-1.23), $p<0.001$].

Hypothesis 1 was accepted. There was an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression. African Americans had better perceived health compared to White participants ($p<0.05$).

After finding significant results for race/ethnicity in the regression analysis for research question 1, race/ethnicity was further studied in research question 2. Research question 2 explored whether race/ethnicity was a moderator variable by looking at the strengths of associations between race/ethnicity, perceived health, self-care, healthy coping, and depression. Interactions terms are shown in Table 14.

Research Question 2: Are there racial/ethnic differences in the strengths of the associations of self-care, healthy coping, and depression with perceived health?

Hypothesis 2: There are racial/ethnic differences of persons with diabetes in the strengths of the associations of self-care, healthy coping, and depression with perceived health.

Table 14

Interaction Terms Between Race/Ethnicity and Variables 'Better or Worse' Perceived Health (Model 2) (n=4,785)

Interaction Term	Weighted P-value
Self-care and Race/Ethnicity	0.68
Healthy coping and Race/Ethnicity	0.82
Depression and Race/Ethnicity	0.62

Table 14 presents the interaction terms between race/ethnicity and 'better or worse' perceived health (Model 2). The interactions were not significant between self-care and race (p=0.68), healthy coping and race (p=0.82), and depression and race (p=0.62).

Hypothesis 2 was rejected as there were no racial/ethnic differences in the strengths of the associations between self-care, healthy coping, and depression with perceived health.

Additional Analysis for Research Questions 1 and 2

Additional analysis was done to better understand the results for both research questions. Table 15 displays descriptive statistics including frequencies, percentages of each race/ethnicity, and covariates.

Table 15

Descriptives by Race/Ethnicity (n=12,429)

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
Demographics					
Age in years (n, %)					
18-49	1,153 (19.6%)	540 (24.9%)	647 (30.4%)	118 (23.6%)	44 (29.7%)
50-59	1,617 (24.9%)	732 (28.5%)	593 (28.7%)	130 (26.5%)	38 (31.1%)
60-69	2,312 (33.1%)	803 (29.4%)	656 (25.9%)	190 (31.0%)	34 (24.1%)
≥70	1,692 (22.3%)	550 (17.2%)	412 (14.9%)	144 (19.0%)	24 (15.0%)
Gender (n, %)					
Male	3,315 (51.5%)	1,067 (44.2%)	1,033 (50.4%)	282 (50.7%)	74 (48.5%)
Female	3,459 (48.5%)	1,558 (55.8%)	1,275 (49.6%)	300 (49.3%)	66 (51.5%)
Education (n, %)					
Less than high school	1,012 (14.4%)	677 (23.1%)	1,115 (47.4%)	95 (14.1%)	31 (24.2%)

-continued Table 15

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
High school grad	2,141 (32.1%)	792 (30.2%)	527 (24.0%)	129 (22.8%)	47 (36.6%)
Some college	1,320 (18.9%)	545 (21.8%)	276 (12.6%)	79 (12.9%)	23 (16.2%)
College or more	2,277 (34.5%)	598 (24.9%)	372 (16.0%)	273 (50.2%)	39 (22.9%)
Years in US (n, %)					
Born in US	6,504 (95.6%)	2,435 (91.7%)	908 (39.8%)	108 (14.0%)	135 (95.6%)
Not born in US and Less than 15 years	33 (0.5%)	33 (1.6%)	194 (9.0%)	88 (16.6%)	1 (1.5%)
Not born in US and 15 years or more	236 (3.9%)	153 (6.7%)	1,190 (51.2%)	380 (69.4%)	4 (2.9%)
Medications					
Taking diabetic pills (n, %)					
Yes	4,747 (70.7%)	1,857 (70.8%)	1,720 (73.8%)	484 (83.4%)	97 (78.6%)

-continued Table 15

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
No	2,021 (29.3%)	766 (29.2%)	586 (26.2%)	98 (16.6%)	43 (21.4%)
Taking insulin (n, %)					
Yes	1,998 (29.2%)	933 (35.9%)	675 (27.6%)	117 (19.6%)	50 (35.1%)
No	4,773 (70.8%)	1,691 (64.1%)	1,633 (72.4%)	465 (80.4%)	90 (64.9%)
Smoking (n, %)					
Everyday	1,066 (29.1%)	368 (27.8%)	201 (20.0%)	43 (27.5%)	20 (23.9%)
Some days	169 (4.7%)	130 (10.0%)	104 (10.8%)	10 (4.5%)	13 (9.3%)
Not at all	2,457 (66.2%)	738 (62.2%)	571 (69.2%)	125 (68.0%)	43 (66.8%)
Co-morbidities					
Hypertension (n, %)					
Yes	4,882 (71.0%)	2,153 (79.7%)	1,540 (64.6%)	403 (68.1%)	96 (67.3%)

-continued Table 15

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
No	1,889 (29.0%)	472 (20.3%)	766 (35.4%)	179 (31.9%)	43 (32.7%)
Coronary Heart Disease (n, %)					
Yes	1,205 (16.9%)	392 (14.2%)	305 (11.3%)	71 (10.0%)	23 (13.9%)
No	5,546 (83.1%)	2,228 (85.8%)	1,999 (88.7%)	509 (90.0%)	117 (86.1%)
Heart Attack (n, %)					
Yes	907 (12.5%)	280 (9.4%)	198 (7.3%)	51 (7.8%)	17 (7.8%)
No	5,863 (87.5%)	2,341 (90.6%)	2,107 (92.7%)	531 (92.2%)	122 (92.2%)
Heart Condition/Disease (n, %)					
Yes	1,288 (18.7%)	395 (14.0%)	254 (10.4%)	62 (9.3%)	21 (12.7%)

-continued Table 15

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
No	5,481 (81.3%)	2,226 (86.0%)	2,054 (89.6%)	520 (90.7%)	118 (87.3%)
Stroke (n, %)					
Yes	554 (7.7%)	302 (11.7%)	195 (8.8%)	39 (6.9%)	15 (8.0%)
No	6,216 (92.3%)	2,320 (88.3%)	2,109 (91.2%)	543 (93.1%)	125 (92.0%)
Weak/Failing Kidneys (n, %)					
Yes	478 (6.6%)	244 (8.6%)	191 (7.2%)	37 (4.9%)	13 (5.6%)
No	6,289 (93.4%)	2,379 (91.4%)	2,114 (92.8%)	545 (95.1%)	127 (94.4%)
Perceived Health Status (n, %)					
Better	1,334 (19.5%)	555 (21.7%)	516 (23.6%)	105 (17.5%)	23 (15.8%)
Worse	1,147 (16.6%)	431 (15.7%)	422 (16.3%)	106 (15.6%)	29 (20.1%)

-continued Table 15

Variable	White (n=6774)	Black (n=2625)	Hispanic (n=2308)	Asian (n=582)	AI/AS (n=140)
About the same	4,293 (63.9%)	1,639 (62.6%)	1,370 (60.0%)	371 (66.8%)	88 (64.0%)

Table 15 displays the sample size for each race/ethnicity. The percentages were weighted and missing race (n=242) (1.9%). Whites were the largest group (n=6,774) and AI/AN was the smallest group at (n=140). For Whites, over half the sample (55.4%) was age 60 and older while 30.4% of Hispanic participants were 18-49. For Hispanics, 47.4% had less than high school education while 50.2% of Asians had college or more education. A majority of Whites, Black/African Americans, and AI/ANs were born in the U.S., while only 14.0% of Asians and 39.8% of Hispanics were born in the U.S. Participants who were on insulin were highest amon Black/African Americans (35.9%) and AI/ANs (35.1%). Participants who smoked everyday were Whites (29.1%), Black/African Americans (27.8%), and Asians (27.5%). Hypertension was highest for Black/African Americans (79.7%) and Whites (71.0%). Coronary heart disease was highest in Whites (16.9%) and Black/African Americans (14.2%). Heart attack was highest for Whites (12.5%) and Black/African Americans (9.4%). Heart condition/disease was highest for Whites (18.7%) and Black/African Americans (14.0%) respectively. Stroke was highest in Black/African Americans (11.7%) and Hispanics (8.8%). Weak/failing kidneys was highest in Black/African Americans (8.6%) and Hispanics (7.2%). Perceived health was better in Hispanics (23.6%) and Black/African Americans (21.75%) and worse in AI/AS (20.1%).

Table 16. Table 16 includes the means and standard errors of self-care, healthy coping, and depression by race/ethnicity.

Table 16

Means and Standard Errors by Race/Ethnicity (n=12,429)

Variable	White (n=6,774)	Black (n=2,625)	Hispanic (n=2,308)	Asian (n=582)	AI/AS (n=140)
Self-Care (Mean ± SE)					
Unable to afford food	3.84 ± 0.03	3.88 ± 0.04	3.76 ± 0.03	3.57 ± 0.05	3.83 ± 0.05
Being inactive	5.31 ± 0.04	5.65 ± 0.06	5.75 ± 0.06	5.13 ± 0.11	5.69 ± 0.28
Unable to monitor health	3.22 ± 0.01	3.26 ± 0.01	3.34 ± 0.02	3.25 ± 0.03	3.47 ± 0.15
Unable to afford medication	3.28 ± 0.02	3.40 ± 0.03	3.32 ± 0.03	3.13 ± 0.03	3.16 ± 0.04
Risky behavior	4.87 ± 0.02	4.77 ± 0.03	4.83 ± 0.03	4.83 ± 0.04	4.81 ± 0.08
Healthy Coping (Mean ± SE)	1.03 ± 0.03	1.11 ± 0.05	1.02 ± 0.05	0.77 ± 0.08	0.66 ± 0.11
Depression (Mean ± SE)	4.34 ± 0.04	4.41 ± 0.06	4.64 ± 0.07	3.93 ± 0.07	4.76 ± 0.27

In Table 16, self-care unable to afford food was the worse for Black/African American (3.88 ± 0.04) and Whites (3.84 ± 0.03). Inactivity was worse for Hispanics (5.75 ± 0.06) and AI/AS (5.69 ± 0.28). Unable to monitor health was worse in AI/AS (3.47 ± 0.15) and Hispanics (3.34 ± 0.02). Black/African Americans (3.40 ± 0.03) and Hispanics (3.32 ± 0.03) were the least able to afford medications. Whites (4.87 ± 0.02), Hispanics (4.83 ± 0.03), and Asians (4.83 ± 0.04) had the most risky behavior. Healthy coping was worse for Black/African Americans (1.11 ± 0.05) and Whites (1.03 ± 0.03). Depression was worse for AI/AS (4.76 ± 0.27) and Hispanics (4.64 ± 0.07).

Table 17 displays better perceived health by race/ethnicity and includes the covariates.

Table 17

Better Perceived Health by Race/Ethnicity (n=2,533)

Variable	White (n=1,334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Demographics					
Age in years (n, %)					
18-49	288 (24.0%)	145 (30.3%)	168 (35.0%)	30 (29.4%)	4 (9.8%)
50-59	333 (27.8%)	165 (31.8%)	141 (31.0%)	23 (25.8%)	5 (21.0%)
60-69	445 (31.3%)	150 (24.3%)	139 (24.2%)	31 (26.3%)	10 (56.6%)
70-79	268 (16.8%)	95 (13.6%)	68 (9.8%)	21 (18.5%)	4 (12.6%)
Gender (n, %)					
Male	621 (50.0%)	253 (47.7%)	212 (45.2%)	53 (45.8%)	12 (51.3%)

-continued Table 17

Variable	White (n=1,334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Female	713 (50.0%)	302 (52.3%)	304 (54.8%)	52 (54.2%)	11 (48.7%)
Education (n, %)					
Less than high school	143 (9.6%)	121 (19.0%)	224 (41.9%)	11 (7.8%)	4 (13.2%)
High school grad	377 (29.0%)	152 (27.6%)	130 (29.4%)	17 (14.3%)	8 (38.8%)
Some college	283 (19.3%)	123 (21.8%)	64 (13.4%)	19 (16.4%)	4 (13.2%)
College or more	529 (42.1%)	156 (31.6%)	94 (15.3%)	57 (61.4%)	7 (34.7%)
Years in US (n, %)					
Born in US	1,291(96.6%)	521 (93.9%)	213 (42.7%)	22 (22.9%)	22 (90.3%)
Not born in US and Less than 15 years	9 (0.6%)	7 (1.0%)	44 (8.8%)	22 (19.5%)	1 (9.7%)
Not born in US and 15 years or more	34 (2.8%)	25 (5.1%)	257 (48.5%)	61 (57.5%)	0
Medications					
Taking diabetic pills (n, %)					

-continued Table 17

Variable	White (n=1,334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Yes	899 (66.9%)	378 (68.8%)	381 (74.7%)	75 (71.4%)	13 (64.4%)
No	435 (33.1%)	176 (31.2%)	135 (25.3%)	30 (28.6%)	10 (35.6%)
Taking insulin (n, %)					
Yes	375 (28.6%)	194 (34.5%)	153 (27.4%)	23 (25.2%)	12 (58.3%)
No	959 (71.4%)	361 (65.5%)	363 (72.6%)	82 (74.8%)	11 (41.7%)
Smoking (n, %)					
Everyday	170 (23.5%)	80 (27.9%)	35 (18.5%)	4 (6.9%)	2 (10.9%)
Some days	33 (4.5%)	25 (7.7%)	23 (11.2%)	2 (3.7%)	1 (6.3%)
Not at all	488 (72.0%)	162 (64.3%)	125 (70.3%)	29 (89.3%)	9 (82.8%)
Co-morbidities					
Hypertension (n, %)					
Yes	938 (69.4%)	458 (81.4%)	356 (64.8%)	67 (61.7%)	16 (69.1%)
No	396 (30.6%)	97 (18.6%)	159 (35.2%)	38 (38.3%)	7 (30.9%)
Coronary Heart Disease (n, %)					
Yes	239 (17.4%)	87 (17.4%)	75 (11.2%)	19 (16.5%)	3 (8.9%)
No	1,091 (82.6%)	464 (82.6%	440 (88.8%)	86 (83.5%)	20 (91.1%)

-continued Table 17

Variable	White (n=1,334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Heart Attack (n, %)					
Yes	164 (11.6%)	60 (9.5%)	46 (7.2%)	12 (10.3%)	1 (1.4%)
No	1,169 (88.4%)	493 (90.5%)	470 (92.8%)	93 (89.7%)	21 (98.6%)
Heart Condition/Disease (n, %)					
Yes	262 (19.6%)	84 (15.1%)	49 (7.4%)	14 (12.1%)	2 (7.5%)
No	1,070 (80.4%)	469 (84.9%)	467 (92.6%)	91 (87.9%)	21 (92.5%)
Stroke (n, %)					
Yes	104 (7.5%)	70 (13.8%)	52 (9.9%)	6 (6.6%)	3 (10.5%)
No	1,229 (92.5%)	484 (86.2%)	463 (90.1%)	99 (93.4%)	20 (89.5%)
Weak/Failing Kidneys (n, %)					
Yes	95 (6.3%)	54 (9.6%)	43 (7.7%)	5 (4.6%)	2 (7.8%)
No	1,239 (93.7%)	501 (90.4%)	473 (92.3%)	100 (95.4%)	21 (92.2%)

In Table 17 the results for better perceived health included sample size for each race/ethnicity with Whites as the largest group (n=1,334) and AI/AS as the smallest group (n=23). A majority of the sample was age 18-59 for Whites, Black/African American, Hispanic, and Asian. Hispanics had less than high school education (41.9%) while a majority of Asians

(61.4%) had college or more education. Almost all of Whites, Black/African Americans, and AI/AS were born in the U.S., while fewer Hispanic (42.7%) and Asians (22.9%) were born in the U.S. Taking insulin was highest in Black/African Americans (34.5%) and AI/AS (58.3%). Smoking everyday was highest in Black/African Americans (27.9%) and Whites (23.5%). Hypertension was highest for Black/African Americans (81.4%) and Whites (69.4%). Coronary heart disease was highest in Whites (17.4%) and Black/African Americans (17.4%). Heart attack was highest for Whites (11.6%) and Asians (10.3%). Heart condition/disease was highest for Whites (19.6%) and Black/African Americans (15.1%). Stroke was highest for Black/African Americans (13.8%) and AI/AS (10.5%). Weak/failing kidneys was highest for Black/African Americans (9.6%) and Hispanics (7.7%).

Table 18 displays the means and standard errors for better perceived health of each race/ethnicity, self-care, healthy coping, and depression.

Table 18

Means and Standard Errors for Better Perceived Health by Race/Ethnicity (n=2,533)

Variable	White (n=1334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Self-Care (Mean ± SE)					
Unable to afford food	3.93 ± 0.04	3.86 ± 0.06	3.66 ± 0.05	3.51 ± 0.03	3.00 ± n/a
Being inactive	4.66 ± 0.09	4.94 ± 0.09	5.31 ± 0.10	4.78 ± 0.07	5.89 ± 0.10

-continued Table 18

Variable	White (n=1334)	Black (n=555)	Hispanic (n=516)	Asian (n=105)	AI/AS (n=23)
Unable to monitor health	3.21 ± 0.02	3.19 ± 0.02	3.26 ± 0.03	3.26 ± 0.02	3.23 ± 0.07
Unable to afford medication	3.27 ± 0.03	3.43 ± 0.05	3.34 ± 0.04	3.13 ± 0.03	3.20 ± 0.04
Risky behavior	4.71 ± 0.03	4.70 ± 0.04	4.78 ± 0.04	4.69 ± 0.05	4.53 ± 0.09
Healthy Coping (Mean ± SE)	0.68 ± 0.05	0.84 ± 0.07	0.72 ± 0.07	0.60 ± 0.09	0.80 ± 0.29
Depression (Mean ± SE)	4.01 ± 0.06	4.14 ± 0.07	4.31 ± 0.10	3.64 ± 0.08	3.24 ± 0.09

n/a=not available due to insufficient variation of the data

In Table 18, self-care unable to afford food was worse for Whites (3.93 ± 0.04) and Black/African Americans (3.86 ± 0.06). Being inactive was worse for AI/AS (5.89 ± 0.10) and Hispanics (5.31 ± 0.10). Unable to monitor health was worse for Asians (3.26 ± 0.02) and Hispanics (3.26 ± 0.03). Unable to afford medication was worse for Black/African Americans (3.43 ± 0.05) and Hispanics (3.34 ± 0.04). Risky behavior was worse in Hispanics (4.78 ± 0.04) and Whites (4.71 ± 0.03). Healthy coping was worse in Black/African Americans (0.84 ± 0.07)

and AI/AS (0.80 ± 0.29). Depression was worse in Hispanics (4.31 ± 0.10) and Whites (4.01 ± 0.06).

Table 19 displays worse perceived health by race/ethnicity and includes the covariates.

Table 19

Worse Perceived Health by Race/Ethnicity (n=2,135)

Variable	White (n=1,147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Demographics					
Age in years (n, %)					
18-49	199 (19.7%)	99 (25.3%)	97 (27.4%)	16 (18.1%)	7 (36.3%)
50-59	332 (29.6%)	134 (32.6%)	114 (28.1%)	20 (23.8%)	11 (38.9%)
60-69	362 (29.7%)	121 (29.5%)	132 (28.6%)	42 (36.7%)	4 (7.9%)
70-79	254 (21.0%)	77 (12.6%)	79 (15.9%)	28 (21.4%)	7 (16.9%)
Gender (n, %)					
Male	515 (47.4%)	150 (39.7%)	192 (49.2%)	44 (42.6%)	15 (31.4%)

-continued Table 19

Variable	White (n=1,147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Female	632 (52.6%)	281 (60.3%)	230 (50.8%)	62 (57.4%)	14 (68.6%)
Education (n, %)					
Less than high school	264 (21.8%)	141 (30.5%)	222 (52.8%)	24 (23.8%)	6 (21.7%)
High school grad	358 (33.1%)	128 (29.4%)	81 (19.8%)	26 (24.0%)	9 (27.3%)
Some college	222 (19.4%)	77 (17.8%)	48 (10.9%)	10 (6.1%)	5 (22.9%)
College or more	296 (25.8%)	81 (22.3%)	68 (16.6%)	44 (46.1%)	9 (28.1%)
Years in US (n, %)					
Born in US	1,092 (95.0%)	402 (93.6%)	173 (45.2%)	19 (10.6%)	29 (100%)
Not born in US and Less than 15 years	9 (0.7%)	5 (1.2%)	32 (7.7%)	12 (14.1%)	0
Not born in US and 15 years or more	46 (4.3%)	23 (5.2%)	212 (47.1%)	73 (75.3%)	0

-continued Table 19

Variable	White (n=1,147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Medications					
Taking diabetic pills (n, %)					
Yes	758 (67.6%)	285 (67.5%)	308 (70.4%)	84 (81.6%)	19 (75.4%)
No	386 (32.4%)	145 (32.5%)	113 (29.6%)	22 (18.4%)	10 (24.6%)
Taking insulin (n, %)					
Yes	428 (37.8%)	181 (41.5%)	177 (39.5%)	25 (16.9%)	14 (45.0%)
No	719 (62.2%)	250 (58.5%)	245 (60.5%)	81 (83.1%)	15 (55.0%)
Smoking (n, %)					
Everyday	274 (40.9%)	71 (31.6%)	51 (24.2%)	11 (30.5%)	5 (29.4%)
Some days	29 (5.3%)	30 (13.3%)	20 (10.2%)	2 (4.9%)	2 (1.5%)
Not at all	392 (53.8%)	117 (55.1%)	114 (65.6%)	24 (64.5%)	11 (69.1%)

-continued Table 19

Variable	White (n=1,147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Co-morbidities					
Hypertension (n, %)					
Yes	880 (76.8%)	383 (88.0%)	319 (73.7%)	82 (77.4%)	20 (66.2%)
No	266 (23.2%)	48 (12.0%)	102 (26.3%)	24 (22.6%)	8 (33.8%)
Coronary Heart Disease (n, %)					
Yes	285 (22.6%)	99 (21.5%)	80 (16.4%)	18 (16.5%)	9 (23.3%)
No	851 (77.4%)	332 (78.5%)	340 (83.6%)	88 (83.5%)	20 (76.7%)
Heart Attack (n, %)					
Yes	224 (18.4%)	74 (13.3%)	58 (11.5%)	7 (8.2%)	9 (18.4%)
No	920 (81.6%)	356 (86.7%)	363 (88.5%)	99 (91.8%)	20 (81.6%)

-continued Table 19

Variable	White (n=1,147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Heart Condition/Disease (n, %)					
Yes	307 (25.8%)	102 (23.6%)	80 (19.4%)	18 (13.8%)	10 (30.7%)
No	839 (74.2%)	329 (76.4%)	342 (80.6%)	88 (86.2%)	18 (69.3%)
Stroke (n, %)					
Yes	140 (11.3%)	65 (15.1%)	51 (12.4%)	7 (5.8%)	4 (5.5%)
No	1,006 (88.7%)	366 (84.9%)	370 (87.6%)	99 (94.2%)	25 (94.5%)
Weak/Failing Kidneys (n, %)					
Yes	172 (14.8%)	65 (14.9%)	54 (11.2%)	15 (7.9%)	2 (5.7%)
No	972 (85.2%)	364 (85.1%)	367 (88.8%)	91 (92.1%)	27 (94.3%)

Table 19 reports the sample size for each race/ethnicity with Whites as the largest group (n=1,147) and AI/AS as the smallest group (n=29). In Whites and Asians, over half the sample was age 60 and older. A majority of Hispanics (52.8%) have less than high school education while Asians (46.1%) have college or more education. Almost all of the Whites and Black/African Americans were born in the U.S. while only 10.6% of the Asians were born in the U.S. Taking insulin was highest for Black/African Americans (41.5%) and AI/AS (45.0%). Smoking everyday was highest for Whites (40.9%) and Black/African Americans (31.6%). Hypertension was highest for Black/African Americans (88.0%) and Whites (76.8%). Coronary heart disease was highest for Whites (22.6%) and AI/AS (23.3%). Heart attack was highest for Whites (18.4%) and AI/AS (18.4%). Heart condition/disease was highest for AI/AS (30.7%) and Whites (25.8%). Stroke was highest for Black/African Americans (15.1%) and Hispanics (12.4%). Weak/failing kidneys was highest for Black/African Americans (14.9%) and Whites (14.8%).

Table 20 displays the means and standard errors of each race/ethnicity, self-care, healthy coping, and depression.

Table 20

Means and Standard Errors for Worse Perceived Health by Race/Ethnicity (n=2,135)

Variable	White (n=1147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Self-Care (Mean ± SE)					
Unable to afford food	4.00 ± 0.03	4.02 ± 0.05	3.86 ± 0.04	3.87 ± 0.05	3.70 ± n/a

-continued Table 20

Variable	White (n=1147)	Black (n=431)	Hispanic (n=422)	Asian (n=106)	AI/AS (n=29)
Being inactive	6.26 ± 0.09	6.42 ± 0.12	6.42 ± 0.12	5.19 ± 0.18	5.89 ± 0.29
Unable to monitor health	3.20 ± 0.02	3.19 ± 0.03	3.31 ± 0.03	3.32 ± 0.06	3.30 ± 0.03
Unable to afford medication	3.67 ± 0.04	3.80 ± 0.05	3.59 ± 0.04	3.09 ± 0.05	3.22 ± 0.02
Risky behavior	4.95 ± 0.04	4.69 ± 0.06	4.72 ± 0.05	4.76 ± 0.08	4.71 ± 0.01
Healthy Coping (Mean ± SE)	2.50 ± .0.10	2.26 ± 0.11	2.34 ± 0.11	1.50 ± 0.15	1.45 ± 0.20
Depression (Mean ± SE)	5.98 ± 0.12	5.47 ± 0.13	6.30 ± 0.15	4.86 ± 0.21	6.49 ± 0.18

Self-care unable to afford food was worse for Black/African Americans (4.02 ± 0.05) and Whites (4.00 ± 0.03). Being inactive was worse for Black/African Americans (6.42 ± 0.12) and Hispanics (6.42 ± 0.12). Unable to monitor health was worse for Asians (3.32 ± 0.06) and Hispanic (3.31 ± 0.03). Unable to afford medication was worse for Black/African Americans

(3.80 ± 0.05) and Whites (3.67 ± 0.04). Risky behavior was worse for Whites (4.95 ± 0.04) and Asians (4.76 ± 0.08). Healthy coping was worse for Whites (2.50 ± 0.10) and Hispanics (2.34 ± 0.11). Depression was worse for AI/AS (6.49 ± 0.18) and Hispanics (6.30 ± 0.15).

Research Question 1 Model 1 + covariates

Model 1 was expanded further by adding the covariates, age, gender, education, years in the U.S., taking diabetic pills, taking insulin, smoking, hypertension, coronary heart disease, heart attack, heart condition/disease, stroke, and weak/failing kidneys. The results are displayed in Table 21.

Table 21

Multivariable Logistic Regression Better or Worse Perceived Health (Model 1 + covariates) (n=4,785)

Variable	OR	95% CI	Weighted P-value
Age			
50-59 vs 18-49	1.74	[1.08, 2.79]	**<0.05**
60-69 vs 18-49	1.71	[1.02, 2.89]	**<0.05**
70-79 vs 18-49	4.46	[2.49, 7.98]	**<0.001**
Gender			
Female vs Male	0.70	[0.47, 1.03]	
Race/ethnicity			
AI/AN vs White	22.95	[3.62, 145.31]	**<0.01**
Asian vs White	3.39	[1.10, 10.42]	**<0.05**
Black/African American vs White	0.68	[0.45, 1.04]	
Hispanic vs White	1.36	[0.70, 2.65]	
Education			

-continued Table 21

Variable	OR	95% CI	Weighted P-value
Less than high school vs college or more	1.90	[1.09, 3.30]	**<0.05**
High school graduate vs college or more	1.11	[0.67, 1.82]	
Some college vs college or more	1.23	[0.73, 2.09]	
Years in the US			
Less than 15 years vs born in US	0.60	[0.25, 1.43]	
15 years or more vs born in US	0.62	[0.31, 1.23]	
Self-care			
Unable to afford food	0.94	[0.79, 1.11]	
Being inactive	1.14	[1.04, 1.24]	**<0.01**
Unable to monitor health	0.93	[0.72, 1.21]	
Unable to afford medication	1.33	[1.16, 1.52]	**<0.001**
Risky behavior	1.16	[0.95, 1.40]	
Healthy coping	1.12	[1.03, 1.22]	**<0.01**
Depression	1.22	[1.14, 1.30]	**<0.001**
Medications			
Taking diabetic pills (no vs yes)	1.37	[0.91, 2.08]	
Taking insulin (no vs yes)	0.93	[0.61, 1.42]	
Smoking			

-continued Table 21

Variable	OR	95% CI	Weighted P-value
Everyday vs not at all	2.21	[1.32, 3.70]	**<0.01**
Some days vs not at all	1.26	[0.65, 2.45]	
Co-morbidities			
Hypertension (yes vs no)	1.01	[0.63, 1.62]	
Coronary heart disease (yes vs no)	1.01	[0.56, 1.82]	
Heart attack (yes vs no)	1.02	[0.62, 1.67]	
Heart condition/disease (yes vs no)	0.83	[0.47, 1.47]	
Stroke (yes vs no)	1.48	[0.76, 2.89]	
Weak/failing kidneys (yes vs no)	0.59	[0.30, 1.19]	

Note. AI/AN=American Indian/Alaska Native; US=United States.
Model 1 + Demographics (Age, Education and Years in US) + Medications + Smoking + Co-morbidities.
OR > 1 indicates higher odds of '**worse**' perceived health compared to better perceived health.

Table 21 displays multivariable logistic regression for better or worse perceived health. In addition to the variables in Model 1+ covariates included demographic variables (age, gender, education, years in the U.S.), medications, smoking, and co-morbidities. The increase in covariates changed the model by identifying significance for age, education, race/ethnicity, and smoking. Worse perceived health increased with age with the most dramatic difference between

age 70-79 compared to age 18-49 [OR=4.46, 95%CI (2.49-7.98), p<0.001]. Worse perceived health was also higher for age 50-59 compared to age 18-49 [OR=1.74, 95%CI (1.08-2.79), p<0.05] and age 60-69 compared to age 18-49 [OR=1.71, 95%CI (1.02, 2.89), p<0.05]. Worse perceived health was reported with AI/AS [OR=22.95, 95%CI (3.62-145.31), p<0.01], Asian [OR=3.39, 95%CI (1.10-10.42), p<0.05], having less than high school education [OR=1.90, 95%CI (1.09-3.30), p<0.05], inactivity [OR=1.14, 95%CI (1.04-1.24), p<0.01], inability to afford medication [OR=1.33, 95%CI (1.16-1.52), p<0.001], less able to have healthy coping [OR=1.12, 95%CI (1.03-1.22), p<0.01], depression [OR=1.22, 95%CI (1.14-1.30), p<0.001], and smoking every day [OR=2.21, 95%CI (1.32-3.70), p<0.01]. Self-care, healthy coping, and depression remain independently significant to perceived health.

The odds ratio for AI/AS was very large at 22.95 and the confidence interval was also large at [3.62, 145.31] indicating a low level of precision of the odds ratio. The sample size is also small at 140. Therefore, the AI/AS results are to be interpreted with caution.

Additional analysis for research question 2 Model 2 +covariates+interactions

Additional analysis was completed for question 2 Model 2+covariates+interactions. Table 22 presents the covariate interaction terms with race/ethnicity and better or worse perceived health. The interactions terms were not significant between self-care and race/ethnicity (p=0.68), healthy coping and race/ethnicity (p=0.82), and depression and race/ethnicity (p=0.62).

Table 22

Interaction Terms Between Race/Ethnicity and Variables Better or Worse Perceived Health (Model 2 + covariates+interactions) (n=4,785)

Interaction Term	Weighted P-value
Age and Race/Ethnicity	0.60

Gender and Race/Ethnicity	0.79
Education and Race/Ethnicity	0.11
Years in the U.S. and Race/Ethnicity	**<0.001**
Self-care and Race/Ethnicity	0.68
Healthy coping and Race/Ethnicity	0.82
Depression and Race/Ethnicity	0.62
Smoking and Race/Ethnicity	0.09
Diabetic pills and Race/Ethnicity	0.90
Insulin and Race/Ethnicity	0.14
Hypertension and Race/Ethnicity	0.88
Coronary heart disease and Race/Ethnicity	0.42
Heart attack and Race/Ethnicity	0.48
Heart condition/disease and Race/Ethnicity	**<0.001**
Stroke and Race/Ethnicity	**<0.001**
Weak/failing kidneys and Race/Ethnicity	**0.043**

The odds of worse perceived health compared to better perceived health was significant among participants with years in the U.S. ($p<0.001$), heart condition/disease ($p<0.001$), stroke ($p<0.001$), and weak or failing kidneys ($p=0.043$). Compared to Whites, Black/African Americans who were not born in the U.S. and lived less than 15 years in the U.S. had better perceived health. Asians with heart condition or stroke reported worse perceived health, while Black/African Americans with weak or failing kidneys had better perceived health. The interaction between race and other variables including age ($p=0.60$), gender ($p=0.79$), education ($p=0.11$), smoking ($p=0.09$), diabetic pills ($p=0.90$), insulin ($p=0.14$), hypertension ($p=0.88$), coronary heart disease ($p=0.42$), and heart attack ($p=0.48$) were not significant.

Table 23 further explored interaction terms between self-care, healthy coping, depression, and race/ethnicity, specifically Asians and Black/African Americans.

Table 23

Interaction Terms Between Asians and Black/African Americans and Self-Care, Healthy Coping, and Depression in Relation to Perceived Health Better or Worse (Model 2 + covariates+interactions by race/ethnicity) (n=1,197)

Interaction Term	Weighted p-value
Self-care and Black/African American	0.41
Healthy coping and Black/African American	0.69
Depression and Black/African American	0.64
Self-care and Asian	0.57
Healthy coping and Asian	0.30
Depression and Asian	0.80

Table 23 displayed the interaction terms between Asians and self-care (p=0.57), healthy coping (p=0.30), and depression (p=0.80). These interaction terms were not significant. The interaction terms between Black/African Americans and self-care (p=0.41), healthy coping (p=0.69), and depression (p=0.64) were not significant.

Summary

Chapter 4 includes the reporting of findings. The three sections included results of the descriptive statistics and research questions 1 and 2.

Results of Descriptive Statistics

Descriptive statistics of the overall study sample was first done. The bivariate analysis reported significant associations of better or worse perceived health with age, education, taking insulin, smoking, hypertension, coronary heart disease, heart attack, heart condition/disease, stroke, weak/failing kidneys, self-care (unable to afford food, being inactive, unable to afford medication, risky behavior), healthy coping, and depression. The bivariate analysis was not significant for race/ethnicity.

Results of Research Question 1

The findings support research question 1. There was an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression. The significant findings included an association of Black/African American participants and better perceived health.

Results of Research Question 2

The findings did not support research question 2, there were no racial/ethnic differences of persons with diabetes in the strengths of the associations of self-care, healthy coping, and depression with perceived health.

Additional Analysis for Research Questions 1 and 2

For research question 1 additional analysis, the descriptive statistics were further analyzed by race/ethnicity. Addition of the covariates to model 1 resulted in significant independent findings for age, education, smoking, self-care, healthy coping, and depression.

Race/ethnicities American Indian/Alaska Natives and Asians had significantly worse perceived health. With the addition of covariates, Black/African Americans no longer had significant results for better perceived health. For research question 2 additional analysis, covariates were added to model 2. Compared to Whites, Black/African Americans who were not born in the U.S. and lived less than 15 years in the U.S. had better perceived health. Asians with heart condition or stroke reported worse perceived health, while Black/African Americans with weak or failing kidneys had better perceived health. The interaction terms between self-care, healthy coping, and depression and Black/African Americans and Asians were not significant for perceived health. There was a significant independent relationship between self-care, healthy coping, depression, and perceived health.

CHAPTER 5. DISCUSSION

The study explored the association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression. Furthermore, racial/ethnic differences in the strengths of the associations of self-care, healthy coping, and depression with perceived health were examined.

Research Question 1

Perceived health was worse in persons with diabetes who were inactive, unable to afford medication, and participating in risky behavior. The researcher found that participants with worse perceived health reported significantly less physical activity. Poor perceived health was associated with higher odds of physical inactivity regardless of having chronic diseases including respiratory, cardiometabolic, and musculoskeletal diseases (Dogra, 2011). Participants with a diabetic foot ulcer who were less physically active reported poor perceived health (Iversen et al., 2009). Better perceived health was associated with exercising at least 30 minutes three times per week (Song & Lee, 2009).

The researcher found that participants with worse perceived health reported significantly less ability to afford their medications. Persons living with diabetes are unable to afford the higher prices of medications and seek alternative less costly options (Reyes, Tripp-Reimer, Parker, Muller, & Laroche (2017).

Participants who had diabetes reported worse perceived health and had higher levels of risky behavior including being less likely to see an eye doctor, foot doctor, or health professional. The current study also asked participants if they had seen a healthcare provider within the past 12 months. Participants who had not seen one reported significantly worse

perceived health. Better perceived health was reported by participants with diabetes who visited their healthcare provider within the past year (Song & Lee, 2009).

Perceived health was worse in persons with diabetes who did not have healthy coping. The researcher found that participants who reported worse perceived health were significantly less able to cope than participants who reported better perceived health. Healthy coping included doing leisure activities as well as socializing. Social support from friends was helpful as they assisted each other in making healthy food choices and provided verbal reminders to resist tempting foods (Reyes et al., 2017).

The current study found depressed participants had worse perceived health. Depression was also caused by unsuccessful efforts to self-manage diabetes (Tannenbaum et al., 2013). Self-rated health was a strong predictor of depressive symptoms (Boehme, Geiser, & Renneberg, 2014). Depression significantly decreased perceived health (Al-Windi, 2005; Alonso et al., 2013; Giuli et al., 2014; Jang et al., 2009; Manuti et al., 2013). The results of the current study concur with the existing literature on self-care, healthy coping, and depression.

Research Question 1: Additional Analysis

Covariates were added to research question 1 to determine if there is an association of race/ethnicity of persons with diabetes with perceived health independent of self-care, healthy coping, and depression. Significant independent relationships with perceived included race/ethnicity (American Indian/Alaska Native), age, education, and smoking. Self-care, healthy coping, and depression continued to have significant independent relationships with perceived health.

The researcher found that worse perceived health was higher in American Indian/Alaska Native persons living with diabetes compared to White participants. However, the results should be viewed with caution due to the small sample size and large odds ratio and confidence interval. In the current study, Asians with diabetes reported worse perceived health. Asians living with diabetes reported worse health related quality of life (Wee, Cheung, Li, Fong & Thumboo, 2005).

Worse perceived health had significant independent relationships with older age, less than high school education, and smoking. In the current study, worse perceived health was higher for age 70-79, age 60-69, and age 50-59 compared to age 18-49. Perceived health was significantly worse in persons with diabetes age 50 and older (Al-Mandhari et al., 2011; Kartal & Inci, 2011; Manuti et al., 2013). It is important to consider age related changes for the older participants which can affect perceived health.

In the current study, participants with less than high school education reported significantly worse perceived health than participants with a college degree or more. Participants with no formal education or primary school education reported significantly worse perceived health compared to participants with a high school or college education (Kartal & Inci, 2011; Manuti et al., 2013). Education was an important socioeconomic indicator which needs to be controlled for (Alang, McCreedy, & McAlpine 2015).

The researcher found that participants who smoked every day reported significantly worse perceived health than those who did not smoke. Current smokers had significantly worse perceived health compared to non-smokers (Manuti et al., 2013). The study results concur with the existing literature.

Research Question 2

In this study, race/ethnicity did not strengthen or weaken the association between self-care, healthy coping, depression, and perceived health. The researcher revisited 24 AADE7 (see Appendix E) studies of which four included race/ethnicity from 2010 to 2018. None of the four studies used race/ethnicity as a moderator variable (DePue et al., 2013; McElfish et al., 2015; McEwen & Murdaugh, 2014; Pemu et al., 2011). Instead, race/ethnicity was included as a demographic variable and not compared with the outcome variable (i e. HbA1c). Two studies included perceived health and race/ethnicity but were not part of the objective of the study (Inouye, Li, Davis, & Arakaki, 2016; Peyrot et al., 2012). In contrast, Paradies et al. (2015) did a systematic literature review and meta-analysis on racism as a determinant of health among patients with chronic diseases (i e. diabetes, hypertension, heart condition, hypercholesterolemia) and found that there were significant associations with depression and race/ethnicity (i e. Asians ($p<0.001$), and Latinos ($p<0.001$)) with race as a moderator variable.

Research Question 2: Additional Analysis

In the current study, Black/African American participants with diabetes and weak/failing kidneys reported better perceived health compared to Whites. Black/African Americans have kidney failure three times the rate as Whites and comprise 35% of patients on dialysis (National Kidney Foundation, 2016). Black/African Americans with end stage renal disease report significantly better health-related quality of life including better well-being and decreased burden of kidney disease compared to non-African Americans (Unruh et al., 2004). One possible reason for the difference in perceived health between the current study and the literature is that once a person has end stage renal disease, they are eligible for Medicare, which covers the cost of dialysis (National Kidney Foundation, 2017). The knowledge that one's health will be taken care

of and that insurance is guaranteed may be the reason for better perceived health for Black/African American participants with weak/failing kidneys.

The current study also found that Black/African Americans who were not born the U.S. and have lived in the U.S. less than 15 years have significantly better perceived health compared to Whites. Alang et al. (2015) found that Black/African American immigrants living in the U.S. for 15 years or more had poor perceived health.

The current study found that Asians with heart condition or stroke were more likely to have worse perceived health. According to the American Heart Association (2016), 6.0% of Asians have heart disease and 1.5% have had a stroke. Two of the most common complications in Asians with type 2 diabetes were ischemic heart disease and stroke (Cheng et al., 2015). Ho et al. (2007) found poor perceived health in Hong Kong Chinese participants with diabetes, coronary heart disease, or stroke.

Strengths and Limitations

The availability of variables from a large data set for use in secondary analysis provided both strengths and limitations. The strengths were financial, scope, and quality. The researcher used a nationally representative data set which was financially cost effective (Boslaugh, 2007; Cheng & Phillips, 2014; Smith et al., 2011). The second strength was the scope of the data: national data sets such as longitudinal data or a population survey provide a breadth and depth of data that the researcher would not have the resources to collect on their own (Boslaugh, 2007; Smith et al., 2011). The third strength was the quality of the data. The data quality was higher with the availability of experienced individuals who assist in data collection, data cleaning, and interpretation (Boslaugh, 2007; Cheng & Phillips, 2014), which resulted in high quality data sets (Thomas & Heck, 2001).

Although secondary analysis has strengths, there are also limitations. Since the data is from a cross-sectional study and only measures a single point in time, the researcher cannot claim causal association because of the cross-sectional nature of the data (Levin, 2006). Significance does not mean cause. However, significant results can only show an association and not cause for a cross-sectional study (Segwick, 2014). The limitations were present because the data has already been collected, in comparison to primary data collection, where the researcher identifies a problem, designs a study, and collects their own data (Smith et al., 2011). The AADE7 framework and questions for NHIS did not always correspond to each other. Face and content validity and reliability between the AADE7 concepts and NHIS questions demonstrate a need to create an instrument which measures the AADE7 concepts. Some of the NHIS questions did not correspond to the AADE7 concepts such as self-care healthy eating and self-care being active, while others directly related to each other. In addition, the researcher was not part of the data collection process which is a limitation (Boslaugh, 2007; Cheng & Phillips, 2014).

In summary, the most important finding from the study is that race is not a modifying variable and does not strengthen the association between self-care, healthy coping, depression, and perceived health. This is a new finding to date that has not been studied in the AADE7 literature with perceived health and race/ethnicity as a moderator variable.

Covariates have a significant independent relationship with perceived health among persons with diabetes. Elderly Korean immigrants reported significantly better perceived health than elderly Koreans in the U.S. despite the Korean immigrants having higher rates of hypertension, hyperlidpidemia, and diabetes (Sin et al., 2011). Covariates were also important for perceived health for participants with HIV and tuberculosis. Zhu et al. (2017) found that perceived health was worse in participants who had both HIV and TB and those participants

were more likely to be older, male, and less educated. Furthermore, participants with primary immune deficiency had worse perceived health if they were older and or had multiple chronic diseases (Seeborg et al., 2015).

Self-care, healthy coping, and depression have a significant independent relationship with perceived health. Participants with who were able to exercise and visit their healthcare provider once a year had better self-care and better perceived health (Song & Lee, 2009). Part of healthy coping is social support. Participants with social support reported better perceived health as measured by questions on general and emotional health (Heinze et al., 2015). Depression had a significant independent relationship and decreased perceived health (Al-Windi, 2005; Giuli et al., 2014; Manuti et al. 2013).

Implications

Future research should include a longitudinal study with repeated measures using the same variables and participants (Caruana, Roman, Hernandez-Sanchez, & Solli, 2015). It is important to add the covariates to have a more comprehensive view of the analysis. Future studies should include additional variables such as age, gender, education, years in the U.S., co-morbidities, medications, and smoking. Socioeconomic status is an important variable to include using education, income, and/or occupation as a proxy (American Psychological Association, 2018).

The instruments used in the 24 AADE7 studies (see Appendix E) were self-management tools (see Appendix E) and focus on only self-management including the Self-Management Profile for type 2 diabetes (SMP-T2D) (Peyrot et al., 2012), Diabetes Self-Care Inventory revised version (SCI-R) (Jansa et al., 2013), and the LMC Confidence and Preparedness Index (SCPI) (Mbuagbaw, Aronson, Walker, Brown, & Orzech, 2017). The researcher would like to

create a tool which includes the AADE7 self-care behaviors and questions on healthy coping, depression and perceived health. There were no tools in the 24 AADE7 articles which included self-care, healthy coping, depression, and perceived health. In the 24 AADE7 studies, race/ethnicity was not studied as a moderator variable.

Implications for practice. It is important to test the AADE7 model in practice with self-care, healthy coping, depression, and perceived health using the covariates. The researcher will first develop and refine an instrument to include the AADE7 with self-care, healthy coping, depression, and perceived health for a multicultural population. The instrument can be tested and further refined over time. The goal is to have the instrument used by nurses when they see the patient in either a clinic or hospital setting. The instrument should be short, simple, and concise for beneficial use in practice settings. Once the instrument has been validated and reliably tested, further use can be included in longitudinal studies. The researcher plans to disseminate the findings in peer-reviewed publications and conferences.

Conclusions

In conclusion, this study adds to the current body of literature by exploring relationships between race/ethnicity, self-care, healthy coping, depression, demographic characteristics, and co-morbidities utilizing the AADE7 Self-Care Behaviors Framework. This study indicates the need to consider in addition to race/ethnicity, self-care, healthy coping, and depression, demographics and co-morbidities to provide a more complete view of the person living with diabetes. In future studies, it is important to utilize refined statistical measurement tools and methods to address the concept of perceived health among persons with diabetes.

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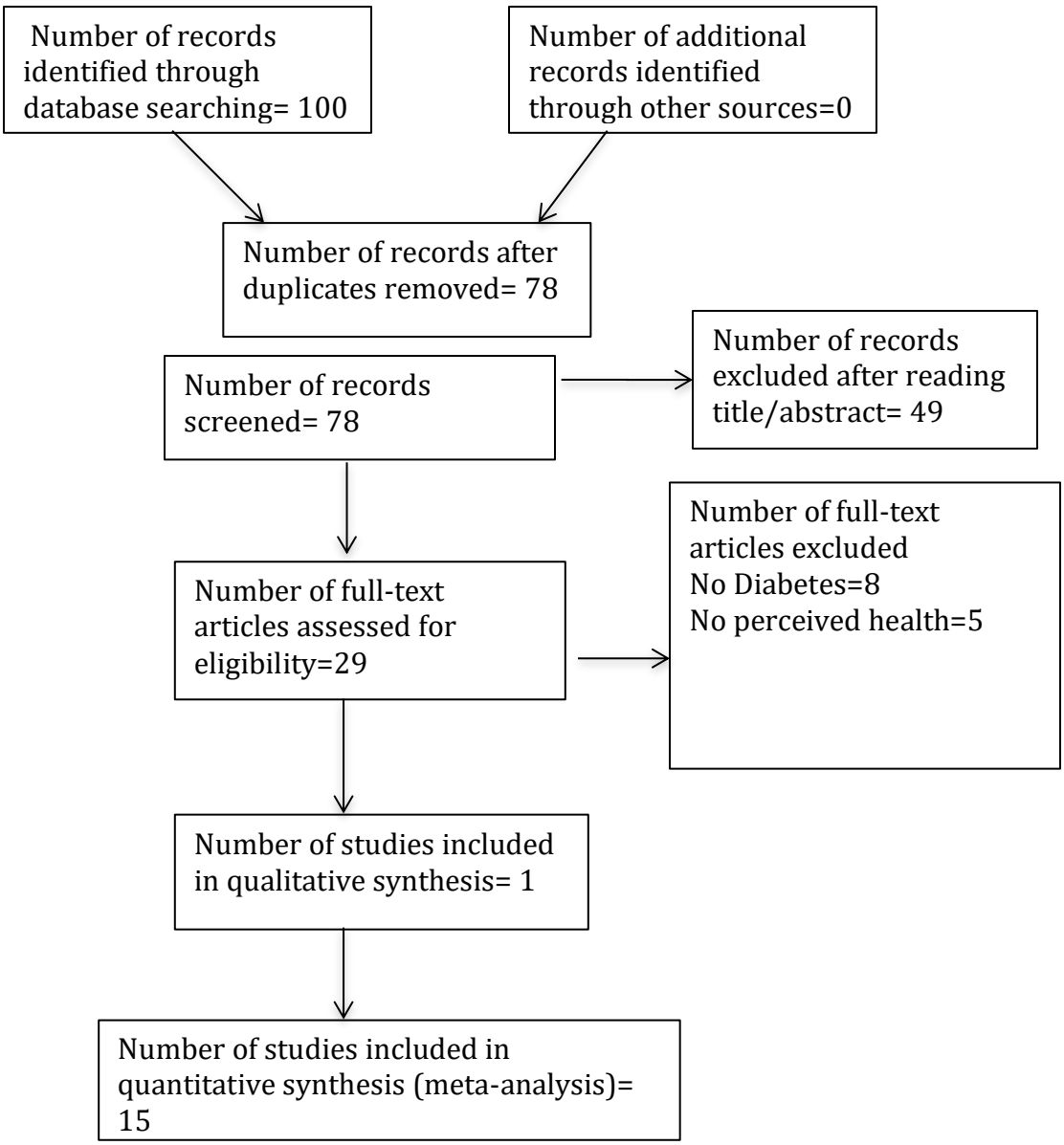
Appendix A

Prisma Flow Diagram

Figure 2: Prisma Flow Diagram (2009)
Key terms: Perceived Health (in title), Diabetes, and Adult



Appendix B

Literature Review Table

Table 24. Perceived health, diabetes, and adult

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
Al-Mandhari et al. (2011) Oman	To assess the impact of diabetes mellitus and hypertension as well as other demographic and clinical characteristics on perceived health status in primary health care centers in Oman	No theory/framework	Age Entire sample 54(2) Diabetes 49(14) Gender Female entire sample 277(62%) Female diabetes 114(65%) Ethnicity N/A Sample size N=450 total N=95(21%) hypertension N=179(39%) diabetes N=179(40%) hypertension and diabetes	Cross-sectional retrospective study	Perceived heath 12-item short form health survey (SF-12) which contains two measures of health status, physical component summary (PCS) and mental component summary (MCS)	Perceived health presence of diabetes and hypertension together was associated with lower physical scores when compared to diabetes alone (p=0.001) No significant differences in mental scores in diabetes, hypertension, diabetes and hypertension Physical scores significantly higher in younger age, males, married, literate, higher income,

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						fewer visits to health center, fewer prescriptions, shorter disease duration in years, and lower systolic blood pressure Mental scores significantly higher in males, married, higher income, fewer visits to the health center, and fewer prescriptions Recommendations/ Implications Consider demographic, socio-economic, and clinical characteristics during delivery of care to improve patient's quality of life

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
Al-Windi (2005) Sweden	To evaluate the effect of socio-demographic characteristics, lifestyle factors, symptoms, somatic and psychiatric conditions as well as health status measures and life satisfaction on perceived health in a multi-ethnic Swedish health practice population	No theory/framework	Age 16-44 120(40.8%) 45-65 212(55.2%) 65 and older 135(38.5%) Gender Female 298(52.8%) Male 169(36.1%) Race/ethnicity Country of birth Sweden 278 Nordic 59 Europe 58 Other 72 Sample size N=470 total N=44 diabetes N=216 depressive disorders	Cross-sectional study	Depression Primary Care Evaluation of Mental Disorders (PRIME-MD) questionnaire, two stage process for diagnosing mental disorders by patient questionnaire (PQ) and interview with a psychologist/ Physician Perceived health Scored on a seven-point scale, 1=very bad, 7=excellent, could not be better Dichotomized into good scores 5-7 and bad or poor 1-4 (PPH)	Depressive disorders 73.8% reported PPH ($p<0.001$) Diabetes 54.5% report PPH, not significant For the entire sample, PPH was significantly higher in age 45-64, women, not working, born in Europe or Other country, live alone, fair or not healthy, low or fair life satisfaction, smoker, higher BMI Logistic regression, PPH significantly higher in persons born in other countries, depressed, having 6 or more

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						symptoms, low or fair life satisfaction Recommendations/ Implications Causal relationships cannot be drawn. Future prospective research is need to clarify the direction of association. Perceived health has a stronger correlation with psychiatric disorders.
Alonso et al. (2013) Spain	To explore the extent to which a multidimensional assessment of disability mediates the association of 19 chronic conditions (9 mental, 10 physical) on perceived health in surveys of the	No theory/framework	Age N/A Gender N/A Ethnicity N/A Age, gender, and ethnicity were not available for the overall sample There was age and gender for	Cross-sectional study Interviews conducted face to face by trained lay interviewers	Self-care WHO Disability Assessment Schedule 2.0 (WHODAS), scores range from 0=no disability to 100=complete disability with questions on understanding and communication,	Self-care Mean score was worse/higher in high and upper-middle income countries compared to low/lower-middle income countries Depression

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	WHO World Mental Health (WMH) surveys initiative, a consortium of cross-sectional general population epidemiological surveys carried out in 22 developing and developed countries throughout the world		individual countries Sample size N=51,344		mobility, self-care including personal hygiene, dressing, eating, living alone, interacting with others Depression Version 3.0 of the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI 3.0), designed to generate diagnosis of mental condition based on the Diagnostic and Statistical Manual of the American Psychiatric Association, IV edition (DSM-IV) Perceived health Visual Analog Scale (VAS),	Decrease in VAS score was highest for neurological conditions, depression, and bipolar disorder Depression had a significant effect (p=0.05) on VAS with an average decrease of 8.17 points Perceived health Respondents with mental conditions showed lower mean perceived health than those with physical conditions Diabetes had a significant (p=0.05) effect on VAS with an average decrease of 5.86 points Recommendations/ Implications

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
					scale of 0 to 100 with 0 as worse possible health and 100 as perfect health. "describe your own overall physical and mental health during the past 30 days"	Address disability to improve health status Evaluate whether interventions to improve disabilities may improve perceived health
Boot et al. (2011) Netherlands	To gain insight into the contribution of work limitations, work characteristics, and work adjustments to the association between health and sick leave in employees with chronic illness	No theory/framework	Age 43(2) Gender Female 3,780(49%) Male 3,968(51%) Race/ethnicity N/A N=7,748 total N=450 diabetes	Cross-sectional study The Netherlands Working Conditions Survey	Perceived health How do you evaluate your health general? Score ranging from 1=excellent to 5=bad	Lower perceived health was significantly associated with more sick leave in each chronic illness group Recommendations/ Implications More longitudinal research to determine the direction of the associations and to distinguish between causes and consequences
Chun et al. (2011) USA	To examine how acculturation affects type 2	No theory/framework	Age 62(9.2)	Interpretive comparative interview study	Interviews	Self-care Affected by language, culture,

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
San Francisco	diabetes management and perceived health for Chinese American immigrants in the U.S.		Gender Male 40% Race/ethnicity Chinese N=19 (13 patients, 6 spouses)			participants speak highly of a Cantonese speaking diabetes nurse educator, better diabetes care provided by physicians in the U.S. compared to China including teaching patient about diet such as eating more vegetables Take walks together several times a week, more cheerful, controls diet better, less stress Depression Separation from China and family affected emotional health due to few relatives and friends Family conflict, felt obligated to

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						send money to relatives in China Other participants found family and social life more relaxing in the U.S. One wife said that her husband stays home all the time, gets depressed, he needs to go outside to take a walk, but is stubborn Perceived health Air and weather is better in the U.S., more lawns, parks, better health care, live longer in the U.S. Recommendations/ Implications Develop culturally appropriate diabetes management recommendations for Chinese

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						immigrants and their families Acculturation and diabetes management
Giuli et al. (2014) Italy	To identify the correlates of perceived health related quality of life in obese, overweight, and normal weight Italian older adults	No theory/framework	Age Normal weight 69.02±6.61 Overweight 69.46±5.69 Obesity 67.76±6.59 Gender Normal weight Female 74.4% Male 25.6% Overweight Female 77.4% Male 22.6% Obesity Female 69.7% Male 30.3% Race/ethnicity N/A	Cross-sectional study	Self-care Social support measured by the Lubben Social Network Scale (LSNS) assesses the extent of social contact with family and friends, score ranges from 0 to 60 with high scores indicate good informal social support Depression The Hospital Anxiety and Depression Scale (HADS), two 7-item scales, one evaluates anxiety, one evaluates depression	Self-care Social support no significant difference between normal weight, overweight, and obese participants and no significant relationship between social support and the physical component summary of SF-36 Depression Significantly negatively associated with general health Significant negative association between physical

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
			Normal weight N=86 Overweight N=53 Obesity N=66		Perceived health Short Form 36-item Health Survey (SF-36) 0=worst health, 100=best health	component (PCS-36) and depression, BMI, and age Perceived health Self-evaluation of health status as fair/poor is reported as significantly higher (p=0.044) for obese participants than normal weight and overweight participants Recommendations/ Implications Fund studies on reducing obesity in the elderly
Glover et al. (2010) USA	To determine racial and ethnic variations in specialty care utilization based on perceived health status and	No theory/framework	Age 18-44 52.6% 45-64 30.6% 65+ 16.8% Gender Female 55.0%	Cross-sectional study Stratified minority sample design The Commonwealth	Perceived health Excellent/good Fair/poor health	Perceived health excellent/good total 84.5% White 85.6% AA 82.8% Asian 87.5% Hispanic 78.0%

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	chronic disease status		Ethnicity White 3488 African American (AA) 1037 Asian 621 Hispanic 1153 N= 6722 Diabetes reported in 8.9% of the total sample, White 8.1%, AA 12.7%, Asian 8.6%, Hispanic 9.9%	Fund's 2001 Health Care Quality Survey, a nationally representative telephone survey of adults living in the US that measure health care utilization and quality of care		Fair/poor health Total 15.5% White 14.4% AA 17.2% Asian 12.5% Hispanic 22.0% Poor perceived health status less likely to receive specialty care Recommendations/ Implications Reduce heat disparities with culturally and linguistically appropriate services
Hart et al. (2005) Netherlands	To investigate perceived health and functioning (PHF) of patients with type 1 diabetes mellitus (DMT1) over time and to compare change in perceived PHF with that of a	No theory/framework	Age Year 1995 38.3(11.5) Year 2001 44.2(11.5) Gender 1995 Male 134(57.3%) 2001 Male 134(57.3%)	Longitudinal study Followed for 6 years between 1995-2001	RAND-36-item Health Survey (RAND-36) 36 items with eight subscales: physical functioning, role limitations due to physical problems, bodily pain, general	Perceived health RAND-36 significant decrease per year for physical functioning, bodily pain, general health, vitality, and physical component summary (PCS)

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	sample of the general population		Race/ethnicity N/A N=281 in 1995 And the dropout rate over 6 years n=47 (16.7%) for a final n=234		health perception, vitality, social functioning, role limitations due to emotional problems, and mental health Scores were scaled from 0=worse health to 100=best health EuroQoL, consists of EQ-5D, scaled 0=dead and 1=perfect health, 5 questions on mobility, self-care, usual activities, pain/discomfort, anxiety/depression and EQ-VAS self-rated health status on 0 to 100 scale	EQ-5D and EQ-VAS significant decrease per year Both RAND-36 and EQ-VAS faster decrease in DMT1 compared to the general population Perceived health and functioning In 2001, macrovascular complications lower EQ-5D, EQ-VAS, PCS, MCS Microvascular complications lower EQ-VAS Comorbidity associated with lower EQ-5D, EQ-VAS, PCS
Huffmann et al. (2013) USA Miami-Dade or	To examine the associations between self-rated health (SRH),	No theory/framework	Age Haitian American 56.1±10.6	Cross-sectional study	Perceived health In general, would you say your health is:	Perceived health Individuals with diabetes had an increased

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
Broward County Florida	perceived stress, and diabetes status among two Black ethnicities (Haitian and African Americans)		African American 52.7±9.5 Gender Haitian American Female 236 Male 122 African American Female 127 Male 122 Race/ethnicity Haitian American 258 African American 249		excellent, very good, good, fair, poor 5-point scale collapsed into a binary variable fair/poor versus good, very good, excellent	likelihood to report fair to poor health Haitian Americans were less likely to report fair to poor health compared to African Americans Recommendations/ Implications Treatment plans should be patient-centered and culturally relevant
Iversen et al. (2009) Norway	To compare levels of anxiety and depression, psychological well-being, and perceived health between persons with diabetes, with or without a history of foot ulcer, and persons without diabetes	No theory/framework	Age Non-diabetic subjects 49.7(17.3) Diabetic subjects without a history of foot ulcer 65.6(13.6)	Cross-sectional study Nord-Trondelag Health Study (HUNT2)	Depression Hospital Anxiety and Depression Scale (HADS), 7 items measure anxiety (HADS-A subscale) and 7 items measure depression (HADS-D subscale), each item scored from	Depression Mean depression score was significantly higher in persons with a history of foot ulcer compared to non-diabetic persons Perceived health

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	in a large study of community-dwelling individuals		Diabetic subjects with a history of foot ulcer 67.2(14.0) Gender Non-diabetic subjects Male 46.7% Diabetic subject without a history of foot ulcer Male 49.7% Diabetic subjects with a history of foot ulcer Male 56.8% Race/ethnicity 3% non-Caucasian N=65, 126 total		0 to 3 with higher scores indicating higher levels of symptom load Perceived health How is your health these days? 1=poor, 4=very good	Both diabetes groups reported worse perceived health than the non-diabetic group Participants with diabetes with or without a history of foot ulcer have significantly higher HADS depression scores, poorer psychological well-being, and worse perceived health compared to participants without diabetes History of foot ulcer was significantly associated with poorer perceived health Older age, female, low education, high BMI, current smoking and

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
			N=63,632 non-diabetic subjects N=1,339 diabetic subjects without a history of foot ulcer N=155 diabetic subjects with a history of foot ulcer			history of stroke or angina pectoris were significantly associated with poorer psychological well-being and perceived health Recommendations/ Implications Identify vulnerable patients with diabetes and offer them more intensive individual support and a foot care program
Jang et al. (2009) USA Tampa and Orlando Florida	Examined changes in the perceived health of older Korean Americans over a 2-year period 2003 (T1) and 2005 (T2)	No theory/framework	Age 68.5(6.40) Gender Female 54.6% Race/ethnicity Korean American N=141	Cross-sectional study	Depression Center for Epidemiological Studies-Depression Scale, a 4-point scale of how often symptoms such as loneliness, feelings of fearfulness, and restless sleep were	Depression More than 30% of the sample (30%at T1 and 32% at T2) have scores 10 or higher, which means probable depression Perceived health Participants with more chronic

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
					experienced during the past week Perceived health How would you rate your overall health at the present time? How is your present health compared to 5 years ago? How much do your health troubles stand in the way of your doing the things you want to do? Test score range 3=positive health perceptions to 10=negative health perceptions	conditions at T1 were more likely to view their health negatively at T2 Increase in chronic conditions and depressive symptoms were identified as significant risks to decline in perceived health Recommendations/ Implications Enhance positive perceptions of health by promoting mental health and teaching management skills for chronic conditions
Kartal & Inci (2011) Turkey	To determine self-perceived health status and metabolic control in patients with	No theory/framework	Age 56.44(12.12) Gender Female 64(58.2%)	Cross-sectional study	Self-perceived health status "How do you rate your state of health in general"	Perceived health is significantly worse for primary/middle school or no education, age 50

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	type 2 diabetes and to understand the relationship between perceived health status and metabolic control in diabetic participants		Male 46(41.8%) Race/ethnicity N/A N=110		very good, good, fair, bad, or poor	and over, insulin, bad treatment adherence, no exercise
Lange and Piette (2005) USA	To assess the association of psychological, as well as physical and sociodemographic, indicators with patients' ratings of personal health status and diabetes control and to investigate the association of mental health and depression with errors in the perception of diabetes control	No theory/framework	Age N/A Gender Female 187 Male 421 Race/ethnicity White/ Caucasian 275 Hispanic/ Latino 188 Other 145 N=623	Cross-sectional study	Perceived general health 1=poor, 5=excellent SF-36 used to measure general mental health	Worse perceived health with insulin use Better perceived health with male, White, make at least $10,000 annually, married, some college Strongest predictor of perceived health was acute symptoms, comorbidities, diabetes complications, mental health, DM worry, and HbA1c
Manuti et al. (2013) Italy	To measure HRQOL of primary care	No theory/framework	Age 18-45 498(33.9%)	Cross-sectional study	Depression Perceived health	Perceived health Worse PCS-12 and MCS-12 reported

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
	patients in one of the poorest areas of Italy, using SF-12, whereas the secondary aim was to identify subgroups of this population, according to socio-demographics, clinical characteristics, behavioral risk factors, and health services utilization, that manifest poorer HRQOL		46-64 541(36.9%) 65 and older 428(29.2%) Gender Female 807(55%) Male 660(45%) Race/ethnicity N/A N=1467 N=167 diabetes		Short Form-12 Health Survey (SF-12), eight health domains aggregated into two summary measures, Physical Component Summary (PCS-12) and the Mental Component Summary (MCS-12) SF-12 General health perception, excellent, very good, good, fair, poor	by patients with at least one chronic disease and the scores decreased with the increasing number of chronic diseases Diabetes significantly lowered PCS-12 score Depression Psychiatric disease significantly lowered MCS-12 and PCS-12 scores SF-12 health domain general health perception, excellent 6.5%, very good 16.6%, good 39.6%, fair 27.3%, poor 10% Recommendations/ Implications Need to develop effective and

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						targeted strategies to improve HRQOL in Southern Italy
Ozcan et al. (2014) UK	To investigate the reasons underlying suboptimal control we have studied clinical characteristics and self-management behaviors in adults with type 1 diabetes attending a large treatment center	No theory/framework	Age 48(15) Gender Female 245(64%) Male 135(36%) Race/ethnicity N/A N=380	Cross-sectional study	Self-care The Gold Hypoglycemia screening tool Measures hypoglycemia awareness Perceived health EuroQoL-Health Status Measure (EQ-5D-5L) provides a descriptive profile of perceived health status, measures 5 dimensions of health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression Visual Analog Scale (VAS)	Self-care Home blood glucose testing, mean of 4.9 tests per day, higher test rate in patients with optimal blood glucose control Diary of blood glucose results, More participants who were hypoglycemia aware had target ranges compared to those with impaired awareness Perceived health Reduced perceived health in patients with poorer glycemic control and those with impaired

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
					1-100 with higher scores for better health related quality of life	hypoglycemia awareness ($p<0.001$) Recommendations/ Implications Integrate psychological and self-management support with intensive medical management
Song & Lee (2009) USA Pennsylvania	To study the relationship between diabetes self-care maintenance (SCM) and perceived health	No framework/theory	Age 60.97(14.08) Gender N/A Race/ethnicity White 633(54.9%) Black 383(33.2%) Others 121(10.5%)	Cross-sectional study	Self-care Routine health behaviors that help to maintain physiological stability General self-care maintenance (SCM) dental visits within one year "About how long has it been since you last had a visit to the dentist?" and DM specific SCM (diet and exercise) "How many servings of fruit	Self-care DM SCM, participants who exercised 3 or more times per week and ate 4 or more servings of fruit and vegetables per day were more likely to report good/excellent health Participants with higher BMI, high blood pressure, high blood cholesterol were

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
					and vegetables do you eat on a typical day? A serving of a fruit or vegetable is equal to a medium apple, half a cup of peas or half a large banana" Perceived health "Would you say your health, in general, is excellent, good, fair, or poor?" Dichotomous variable poor/fair versus good/excellent	less likely to report good or excellent health Participants who visited the dentist within the past year were less likely to report good or excellent health Perceived health Compared to Caucasians, Black, or other participants were less likely to report good or excellent health Recommendations/ Implications Evaluate the relationship between self-care and co-morbid conditions

Reference	Purpose of Study	Theory/ Framework	Sample	Design/Method	Related Measures	Salient Findings
						Interventions to improve DM self-care practices

Appendix C

Additional Analysis

Variable	Total (n=10,495)	Perceived Health†		Weighted P-value
		Better (n=2,609)	About the Same (n=7,886)	
	n (%) (Weighted)	n (%) (Weighted)	n (%) (Weighted)	
Demographics				
Age				**<0.001***
18-49	2,133 (22.7)	657 (29.6)	1,476 (70.4)	
50-59	2,541 (25.6)	680 (27.6)	1,861 (72.4)	
60-69	3,392 (31.4)	800 (22.5)	2,592 (77.5)	
70-79	2,429 (20.3)	472 (18.2)	1,957 (81.8)	
Gender (n, %)				**0.014***
Male	4,945 (50.8)	1,176 (23.3)	3,769 (76.7)	
Female	5,550 (49.2)	1,433 (25.8)	4,117 (74.1)	
Race/Ethnicity (n, %)				**<0.001***
White	5,627 (62.1)	1,334 (23.4)	4,293 (76.6)	
Black	2,194 (16.5)	555 (25.8)	1,639 (74.2)	
American Indian/Alaska Native	111 (0.98)	23 (19.8)	88 (80.2)	
Hispanic	1,886 (16.0)	516 (28.2)	1,370 (71.8)	
Asian	476 (4.5)	105 (20.8)	371 (79.2)	
Education				**<0.001***
Less than high school	2,304 (19.7)	513 (21.2)	1,791 (78.8)	
High school grad	3,103 (30.2)	711 (23.0)	2,392 (77.0)	
Some college	1,923 (18.3)	515 (25.5)	1,408 (74.5)	
College or more	3,118 (31.7)	860 (27.7)	2,258 (72.3)	
Years in U.S.				0.254
Born in U.S.	8,553 (82.4)	2,133 (24.8)	6,420 (75.2)	
Not born in U.S. and less than 15 years	297 (2.8)	85 (26.4)	212 (73.6)	
Not born in U.S. and 15 years or more	1,626 (14.8)	387 (22.7)	1,239 (77.3)	
Medications				
Taking diabetic pills				**<0.001***
Yes	7,597 (72.5)	1,795 (23.3)	5,802 (76.7)	
No	2,893 (27.5)	813 (27.8)	2,080 (72.2)	
Taking insulin				0.178
Yes	3,002 (27.9)	777 (25.8)	2,225 (74.2)	
No	7,489 (72.1)	1,832 (24.1)	5,657 (75.9)	

Smoking				0.196
Everyday	1,320 (25.7)	306 (21.6)	1,014 (78.4)	
Some days	352 (6.1)	86 (22.8)	266 (77.2)	
Not at all	3,348 (68.2)	841 (24.7)	2,507 (75.3)	
Co-morbidities				
Hypertension				0.584
Yes	7,550 (70.0)	1,897 (24.7)	5,653 (75.3)	
No	2,939 (30.0)	710 (24.1)	2,229 (75.9)	
Coronary Heart Disease				**0.007***
Yes	1,543 (14.1)	437 (28.1)	1,106 (71.9)	
No	8,931 (85.9)	2,163 (23.9)	6,768 (76.1)	
Heart Attack				0.590
Yes	1,109 (9.9)	291 (25.4)	818 (74.6)	
No	9,379 (90.1)	2,314 (24.4)	7,065 (75.6)	
Heart Condition/Disease				**0.021***
Yes	1,551 (14.7)	432 (27.4)	1,119 (72.6)	
No	8,936 (85.3)	2,173 (24.0)	6,763 (76.0)	
Stroke				0.059
Yes	859 (7.9)	241 (27.9)	618 (72.1)	
No	9,627 (92.1)	2,365 (24.2)	7,262 (75.8)	
Weak/Failing Kidneys				**0.004***
Yes	672 (1.8)	207 (31.2)	465 (68.8)	
No	9,817 (94.4)	2,402 (24.14)	7,415 (75.9)	
Depression (Mean ± SE)	4.11 ± 0.03	4.09 ± 0.05	4.11 ± 0.03	0.647
Healthy Coping (Mean ± SE)	0.78 ± 0.02	0.72 ± 0.04	0.79 ± 0.03	0.125
Self-Care				
Unable to afford food (Mean ± SE)	3.78 ± 0.03	3.82 ± 0.03	3.76 ± 0.03	0.281
Being inactive (Mean ± SE)	5.28 ± 0.03	4.84 ± 0.07	5.42 ± 0.04	**<0.001***
Unable to monitor health (Mean ± SE)	3.26 ± 0.01	3.22 ± 0.01	3.27 ± 0.01	**0.003***
Unable to afford medication (Mean ± SE)	3.24 ± 0.01	3.31 ± 0.02	3.21 ± 0.01	**<0.001***
Risky behavior (Mean ± SE)	4.85 ± 0.02	4.73 ± 0.03	4.88 ± 0.02	**<0.001***

†Weighted Row Percentage; SE=Standard Error. Higher mean score is worse.
*indicates significance at $p<0.05$.

Descriptive Statistics Worse vs About the Same

Variable	Total (n=10,062)	Perceived Health†		Weighted P-value
		Worse (n=2,176)	About the Same (n=7,886)	
	n (%) (Weighted)	n (%) (Weighted)	n (%) (Weighted)	
Demographics				
Age				**<0.001***
18-49	1,907 (21.3)	431 (21.2)	1,476 (78.8)	
50-59	2,484 (25.6)	623 (23.9)	1,861 (76.1)	
60-69	3,269 (31.7)	677 (19.2)	2,592 (80.8)	
70-79	2,402 (21.3)	445 (17.9)	1,957 (82.1)	
Gender (n, %)				**0.001***
Male	4,703 (46.7)	934 (18.9)	3,769 (81.1)	
Female	5,359 (53.3)	1,242 (22.4)	4,117 (77.6)	
Race/Ethnicity (n, %)				0.744
White	5,440 (55.0)	1,147 (20.6)	4,293 (79.4)	
Black	2,070 (20.9)	431 (20.0)	1,639 (80.0)	
American Indian/Alaska Native	117 (1.2)	29 (23.9)	88 (76.1)	
Hispanic	1,792 (18.1)	422 (21.4)	1,370 (78.6)	
Asian	477 (4.8)	106 (19.0)	371 (81.0)	
Education				0.400
Less than high school	2,451 (24.5)	660 (25.9)	1,791 (74.1)	
High school grad	3,004 (30.0)	612 (20.0)	2,392 (80.0)	
Some college	1,781 (17.8)	373 (20.0)	1,408 (80.0)	
College or more	2,773 (27.7)	515 (17.6)	2,258 (82.4)	
Years in U.S.				**<0.001***
Born in U.S.	8,174 (81.4)	1,754 (20.9)	6,420 (79.1)	
Not born in U.S. and less than 15years	270 (2.7)	58 (18.5)	212 (81.5)	
Not born in U.S. and 15 years or more	1,595 (15.9)	356 (19.2)	1,239 (80.8)	
Medications				
Taking diabetic pills				**<0.001***
Yes	7,285 (72.5)	1,483 (19.4)	5,802 (80.6)	
No	2,768 (27.5)	688 (23.5)	2,080 (76.5)	
Taking insulin				**<0.001***
Yes	3,062 (30.4)	837 (26.2)	2,225 (73.8)	
No	6,996 (69.6)	1,339 (18.2)	5,657 (81.8)	
Smoking				**<0.001***
Everyday	1,436 (28.9)	422 (29.4)	1,014 (70.6)	
Some days	352 (7.1)	86 (24.8)	266 (75.2)	
Not at all	3,178 (64.0)	671 (19.7)	2,507 (80.3)	

Co-morbidities				
Hypertension				**<0.001***
Yes	7,374 (73.3)	1,721 (22.5)	5,653 (77.5)	
No	2,681 (26.7)	452 (15.8)	2,229 (84.2)	
Coronary Heart Disease				**<0.001***
Yes	1,604 (16.0)	498 (28.8)	1,106 (71.2)	
No	8,433 (84.0)	1,665 (19.0)	6,768 (81.0)	
Heart Attack				**<0.001***
Yes	1,199 (11.9)	381 (29.8)	818 (70.2)	
No	8,855 (88.1)	1,790 (19.4)	7,065 (80.6)	
Heart Condition/Disease				**<0.001***
Yes	1,648 (16.4)	529 (30.6)	1,119 (69.4)	
No	8,408 (83.6)	1,645 (18.6)	6,763 (81.4)	
Stroke				**<0.001***
Yes	894 (8.9)	276 (29.1)	618 (70.9)	
No	9,160 (91.1)	1,898 (19.8)	7,262 (80.2)	
Weak/Failing Kidneys				**<0.001***
Yes	783 (7.8)	318 (41.6)	465 (58.4)	
No	9,267 (92.2)	1,852 (19.0)	7,415 (81.0)	
Depression (Mean ± SE)	4.49 ± 0.04	5.94 ± 0.09	4.11 ± 0.03	**<0.001***
Healthy Coping (Mean ± SE)	1.12 ± 0.03	2.39 ± 0.08	0.79 ± 0.03	**<0.001***
Self-Care				
Unable to afford food (Mean ± SE)	3.83 ± 0.02	3.96 ± 0.03	3.76 ± 0.03	**<0.001***
Being inactive (Mean ± SE)	5.58 ± 0.04	6.26 ± 0.07	5.42 ± 0.04	**<0.001***
Unable to monitor health (Mean ± SE)	3.26 ± 0.01	3.23 ± 0.01	3.27 ± 0.01	**0.013***
Unable to afford medication (Mean ± SE)	3.30 ± 0.01	3.65 ± 0.03	3.21 ± 0.01	**<0.001***
Risky behavior (Mean ± SE)	4.88 ± 0.02	4.87 ± 0.03	4.88 ± 0.02	0.686

†Weighted Row Percentage; SE=Standard Error. Higher mean score is worse.
*indicates significance at $p<0.05$.

Multivariable Logistic Regression for Perceived Health

Variable	About the Same vs Better[α]	Worse vs About the Same[β]	Worse vs Better[γ]
	Model 1 OR (95% CI)	Model 1 OR (95% CI)	Model 3 OR (95% CI)
Race/Ethnicity			
AI/AN vs White	4.77 (0.85, 26.86)	0.97 (0.42, 2.24)	4.04 (0.76, 21.63)
Asian vs White	1.22 (0.65, 2.31)	0.84 (0.37, 1.86)	1.67 (0.63, 4.43)
Black vs White	0.84 (0.63, 1.12)	0.74 (0.55, 0.99)*	0.66 (0.46, 0.93)*
Hispanic vs White	0.93 (0.68, 1.26)	0.77 (0.57, 1.05)	0.77 (0.53, 1.11)
Depression	1.02 (0.98, 1.08)	1.13 (1.09, 1.18)***	1.17 (1.10, 1.23)***
Healthy Coping	0.98 (0.93, 1.03)	1.14 (1.09, 1.2)***	1.14 (1.06, 1.21)***
Self-Care			
Unable to afford food	0.93 (0.82, 1.05)	1.02 (0.91, 1.15)	0.95 (0.82, 1.11)
Being inactive	1.13 (1.08, 1.19)***	1.06 (1.00, 1.11)*	1.20 (1.13, 1.28)***
Unable to monitor health	1.23 (1.05, 1.44)*	0.82 (0.69, 0.98)*	0.92 (0.73, 1.17)
Unable to afford medication	0.97 (0.88, 1.08)	1.17 (1.06, 1.30)**	1.18 (1.04, 1.33)*
Risky behavior	1.07 (0.97, 1.18)	1.04 (0.94, 1.17)	1.18 (1.04, 1.33)**

***p<0.001, **p<0.01, *p<0.05; AI/AN=American Indian/Alaska Native; US=United States.
Model 1 = Race/Ethnicity + Depression + Coping + Self-care.
[α]OR > 1 indicates higher odds of '**about the same**' health status compared to better health status.
[β]OR > 1 indicates higher odds of '**worse**' health status compared to about the same health status.
[γ]OR > 1 indicates higher odds of 'worse' health status compared to better health status.

Multivariable Logistic Regression for Perceived Health Including Covariates

Variable	About the Same vs Better[α]	Worse vs About the Same[β]	Worse vs Better[γ]
	Model 2 OR (95% CI)	Model 2 OR (95% CI)	Model 2 OR (95% CI)
Age			
50-59 vs 18-49	1.61 (1.13, 2.32)**	0.88 (0.59, 1.31)	1.74 (1.08, 2.79)*
60-69 vs 18-49	2.59 (1.61, 4.18)***	0.56 (0.36, 0.87)*	1.71 (1.02, 2.89)*
70-79 vs 18-49	5.05 (2.65, 9.61)***	0.64 (0.37, 1.13)	4.46 (2.49, 7.98)***
Gender (Female vs Male)	0.60 (0.42, 0.87)**	1.18 (0.87, 1.60)	0.70 (0.47, 1.03)
Race/Ethnicity			
AI/AN vs White	16.20 (2.12, 123.75)**	0.80 (0.19, 3.38)	22.95 (3.62, 145.31)**
Asian vs White	4.03 (1.36, 11.91)*	0.69 (0.23, 2.09)	3.39 (1.10, 10.42)*
Black vs White	0.97 (0.67, 1.42)	0.66 (0.46, 0.96)*	0.68 (0.45, 1.04)
Hispanic vs White	1.10 (0.69, 1.75)	0.96 (0.53, 1.74)	1.36 (0.70, 2.65)
Education			
Less than high school vs College or more	1.67 (1.00, 2.77)*	1.04 (0.61, 1.79)	1.90 (1.09, 3.30)*
High school grad vs College or more	1.32 (0.86, 2.02)	0.94 (0.57, 1.55)	1.11 (0.67, 1.82)
Some college vs College or more	1.54 (0.93, 2.55)	0.68 (0.38, 1.24)	1.23 (0.73, 2.09)
Years in U.S.			
Less than 15 years vs Born in U.S.	0.86 (0.31, 2.36)	0.61 (0.21, 1.75)	0.60 (0.25, 1.43)
15 years or more vs Born in U.S.	0.72 (0.44, 1.17)	0.94 (0.54, 1.62)	0.62 (0.31, 1.23)
Depression	1.06 (1.00, 1.13)*	1.10 (1.05,1.15)***	1.22 (1.14, 1.30)***
Healthy Coping	0.96 (0.89, 1.04)	1.14 (1.07,1.22)***	1.12 (1.03, 1.22)**
Self-Care			
Unable to afford food	0.96 (0.81, 1.13)	1.04 (0.89, 1.22)	0.94 (0.79, 1.11)
Being inactive	1.09 (1.01, 1.17)*	1.06 (0.98, 1.14)	1.14 (1.04, 1.24)**
Unable to monitor health	1.35 (1.06, 1.71)*	0.77 (0.62, 0.95)*	0.93 (0.72, 1.21)
Unable to afford medication	1.05 (0.92, 1.20)	1.16 (1.03, 1.30)*	1.33 (1.16, 1.52)***
Risky behavior	1.08 (0.93, 1.27)	1.02 (0.87, 1.19)	1.16 (0.95, 1.40)
Medications			
Taking diabetic pills (No vs Yes)	0.82 (0.57, 1.18)	1.46 (1.05, 2.02)*	1.37 (0.91, 2.08)
Taking Insulin (No vs Yes)	1.21 (0.83, 1.76)	0.76 (0.53, 1.09)	0.93 (0.61, 1.42)
Smoking			
Everyday vs Not at all	1.12 (0.71, 1.78)	1.46 (0.95, 2.26)	2.21 (1.32, 3.70)**
Some days vs Not at all	1.20 (0.66, 2.17)	0.94 (0.51, 1.72)	1.26 (0.65, 2.45)

Co-morbidities			
Hypertension (Yes vs No)	0.94 (0.64, 1.36)	1.15 (0.76, 1.74)	1.01 (0.63, 1.62)
Coronary Heart Disease (Yes vs No)	1.06 (0.61, 1.84)	1.19 (0.79, 1.80)	1.01 (0.56, 1.82)
Heart Attack (Yes vs No)	0.81 (0.44, 1.50)	1.22 (0.79, 1.90)	1.02 (0.62, 1.67)
Heart Condition/Disease (Yes vs No)	0.79 (0.48, 1.30)	1.08 (0.69, 1.70)	0.83 (0.47, 1.47)
Stroke (Yes vs No)	1.34 (0.81, 2.24)	0.87 (0.48, 1.57)	1.48 (0.76, 2.89)
Weak/Failing Kidneys (Yes vs No)	1.04 (0.48, 2.22)	0.70 (0.42, 1.16)	0.59 (0.30, 1.19)

***p<0.001, **p<0.01, *p<0.05; AI/AN=American Indian/Alaska Native; US=United States.
Model 2 = Model 1 + Demographics (Age, Education and Years in US) + Medications + Smoking + Co-morbidities.
[α]OR > 1 indicates higher odds of '**about the same**' perceived health compared to better perceived health.
[β]OR > 1 indicates higher odds of '**worse**' perceived health compared to about the same perceived health.
[γ]OR > 1 indicates higher odds of '**worse**' perceived health compared to better perceived health.

Interaction Between Race/Ethnicity and Variables for Perceived Health

Interaction term	**Weighted P-value**
Worse vs Better	
Age*Race/Ethnicity	0.60
Gender*Race/Ethnicity	0.79
Education*Race/Ethnicity	0.11
Years in the U.S.*Race/Ethnicity	**<0.001***
Depression*Race/Ethnicity	0.62
Healthy Coping*Race/Ethnicity	0.82
Self-Care*Race/Ethnicity	0.68
Smoking*Race/Ethnicity	0.09
Diabetic Pills*Race/Ethnicity	0.90
Insulin*Race/Ethnicity	0.14
Hypertension*Race/Ethnicity	0.88
Coronary Heart Disease*Race/Ethnicity	0.42
Heart Attack*Race/Ethnicity	0.48
Heart Condition/Disease*Race/Ethnicity	**<0.001***
Stroke*Race/Ethnicity	**<0.001***
Weak/Failing Kidneys*Race/Ethnicity	**0.043***
Worse vs About the same	
Age*Race/Ethnicity	0.15
Gender*Race/Ethnicity	0.81
Education*Race/Ethnicity	0.15
Years in the U.S.*Race/Ethnicity	**<0.001***
Depression*Race/Ethnicity	0.61
Healthy Coping*Race/Ethnicity	0.36
Self-Care*Race/Ethnicity	0.18
Smoking *Race/Ethnicity	0.34
Diabetic Pills*Race/Ethnicity	0.53
Insulin*Race/Ethnicity	0.18
Hypertension*Race/Ethnicity	0.83
Coronary Heart Disease*Race/Ethnicity	0.57
Heart Attack*Race/Ethnicity	0.81
Heart Condition/Disease*Race /Ethnicity	0.29
Stroke*Race/Ethnicity	0.92
Weak/Failing Kidneys*Race/Ethnicity	**0.008***

About the Same vs Better	
Age*Race/Ethnicity	0.26
Gender*Race/Ethnicity	0.13
Education*Race/Ethnicity	0.60
Years in the U.S.*Race/Ethnicity	0.38
Depression*Race/Ethnicity	0.15
Healthy Coping*Race/Ethnicity	0.91
Self-Care*Race/Ethnicity	0.10
Smoking *Race/Ethnicity	0.52
Diabetic Pills*Race/Ethnicity	0.23
Insulin*Race/Ethnicity	**0.037***
Hypertension*Race/Ethnicity	0.40
Coronary Heart Disease*Race/Ethnicity	0.80
Heart Attack*Race/Ethnicity	0.89
Heart Condition/Disease*Race /Ethnicity	**<0.001***
Stroke*Race/Ethnicity	**<0.001***
Weak/Failing Kidneys*Race/Ethnicity	0.79

Appendix D

Covariates in the Literature Review

Study	Age	Gender	Education	Years in the U.S.	Diabetes	Medications	Smoking	Co-morbidities
Al-Mandhari et al. (2011)	X	X			X		X	X
Al-Windi (2005)	X	X			X			X
Alonso et al. (2013)	X	X			X			X
Boot et al. (2011)	X	X	X		X			X
Chun et al. (2011) qualitative study		X		X	X			
Giuli et al. (2014)	X	X	X		X		X	X
Glover et al. (2010)	X	X	X		X			X
Hart et al. (2005)	X	X	X		X	X		X
Huffmann et al. (2013)	X	X	X		X			
Iversen et al. (2009)	X	X	X		X		X	X
Jang et al. (2009)	X	X	X	X	X			X
Kartal & Inci (2011)	X	X	X		X	X		

Study	Age	Gender	Education	Years in the U.S.	Diabetes	Medications	Smoking	Co-morbidities
Lange & Piette (2005)	X	X	X		X			X
Manuti et al. (2013)	X	X	X		X		X	X
Ozcan et al. (2014)	X	X			X	X		
Song & Lee (2009)	X	X	X		X			X

Appendix E

Covariates in the AADE7 Concepts Literature Review
Key terms AADE7, perceived health, and adult

Study	Age	Gender	Education	Years in the U.S.	Diabetes	Medications	Smoking	Co-morbidities
Cho et al. (2012)					X			
Cunningham et al. (2018)	X	X			X			
DePue et al. (2010)					X			
DePue et al. (2013)	X	X	X		X		X	
Diabetes Technology Society (2016)	X	X			X			
Fisher et al. (2012)	X	X			X	X		
Hamid et al. (2014)	X	X			X			
Inouye et al. (2016)	X	X	X		X			
Jack et al. (2014)					X			
Jansa et al. (2013)	X	X	X		X			
Katula et al. (2017)	X	X	X		X	X		X
Kent et al. (2010)					X			

Study	Age	Gender	Education	Years in the U.S.	Diabetes	Medications	Smoking	Co-morbidities
Kesavadev et al. (2014)					X			
Kirk et al. (2011)	X	X	X		X			
Lewinski et al. (2017)					X			
McElfish et al. (2015)	X	X	X		X			
McEwen et al. (2014)	X	X			X			
Mbuagbaw et al. (2017)	X	X	X		X			
Pemu et al. (2011)	X	X	X		X			
Peyrot et al. (2012)	X	X			X	X		
Powers et al. (2015)					X			
Shrivastava et al. (2013)					X			
Stumetz et al. (2016)	X		X		X			
Welch et al. (2015)	X	X			X			